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Faculty of Economics

Proceedings of the 14th International Conference

Liberec Economic Forum 2019



17th – 18th September 2019
Liberec, Czech Republic, EU



TECHNICAL UNIVERSITY OF LIBEREC
Faculty of Economics



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Table of Contents

Section I Entrepreneurship and Social Responsibility

Simona Činčalová	10
Possible Causes of Gender Employment Gap in European Countries	
Alexander Fichter	19
Creativity within Boundaries: Social identity and the Development of New Ideas in Franchise Systems	
Michaela Krechovská, Kateřina Mičudová, Alena Staňková	45
Challenge of Sustainable Reporting: Case Study of Major Companies in the Czech Republic	
Petra Taušl Procházková, Kristýna Machová	53
Sustainability and Corporate Social Responsibility in Business	
Pavla Švermová	63
CSR of Socially Sensitive Sectors: A Case Study of Companies in the Gambling Industry	

Section II Entrepreneurship and Innovation

Martina Benešová, John Anchor	72
The Earnings Expectations of Business Economics Students in the Czech Republic and England: The Effect of Seniority	
Karina Benetti, Mahmoud Elsayed, Amr Soliman, Dalia Khalil	81
Credibility Modelling for Extreme Losses of Natural Hazards in Czech Republic: An Actuarial Approach	
Karol Čarnogurský, Anna Diačíková, Peter Madzík	93
Perception of Customer Environmental Requirements in Relation to the Product	
Jaroslav Demel, Petr Blaschke	102
Innovation Activities of Foreign Companies Presented in the Liberec Region	
Eva Fuchsová, Jitka Laštovková, Michaela Jánská	111
Willingness to Start Up a Business and the Social Capital in a Regional Context	
Heikki Immonen	119
A Systems Engineering -Inspired Method for Studying Entrepreneurship Programs	
Nikolay Kunyaev, Livon Martynov	126
Conceptual System of Principles Classification and its Application by Management Systems of Modern Organizations at Various Phases of their Life Cycle	
Peter Madzík, Jan Takáč	135
Comparison of AHP and Kano Model to Evaluate the Importance of Customer Requirements in Product Design	
Roman Vavrek	145
TOPSIS Technique and Its Theoretical Background	

Section III

Transparency in the Public Sector

Hana Benešová, John Anchor	154
Gift vs Bribe: What Counts as Corruption?	
Diana Bílková	163
Living Standard in OECD Member Countries	
Blanka Brandová	172
Nominal Convergence in the New EU Member States: Comparative Analysis	
Simona Hašková.....	180
New Approach to Short-Term GDP Prediction: from Statistics to Fuzzy Model	
Martina Hedvičáková, Alena Pozdílková	189
Analysis of Health Care Expenditures in the Czech Republic and European Union	
Aris Kaloudis, Ondřej Svoboda	198
Quality of Government, Stocks of Innovation Skills and Level of Economic Activity in European Regions	
Aleš Kresta	206
Relationship of Fair Value Estimated by Analysts and Price Movement in Case of ČEZ, a.s. stock	
Klára Kubíčková	214
Strategic Philanthropy and Philanthropic Strategy	
Petr Límán	222
Changes in Economic Institutions - Impact of The Great Depression on The United States' Government's Role	
Lukáš Melecký.....	229
Regional Development Potential: How to Define and Evaluate it in an EU context?	
Martin Petříček.....	238
Price Elasticity in the Market of Accommodation Services - Empirical Study in Berlin, Warsaw and Prague	
Michaela Staníčková.....	247
Best Way to Assess Resilience? Theoretical and Methodological Clarification of Resilience	

Section IV

Entrepreneurship and Industry 4.0

Petr Bartoš, Filip Habarta	258
Optimization of Clickable Elements on the Websites Based on User Behaviour	
Petr Doucek, Miloš Maryška, Lea Nedomová	270
Economic Efficiency of Internet of Things	
Jiří Franek, Miroslav Hučka, Zuzana Čvančarová	281
Factors of Entrepreneurial Opportunity and Discovery in the Digital Economy Age	
Kateřina Maršíková, Anastasiia Mazurchenko	291
Digitalization: Transforming the Nature of HRM Processes and HR Professionals' Competencies	
Jan Ministr.....	302
The Minimize of Employee Error or Fraud by Help of Compliance Management System	
Natalie Pelloneová, Eva Štichhauerová	310
Performance Evaluation of Automotive Cluster Member Companies in the Czech Republic and Slovakia	

Márcio Rodrigues, Beatriz Mendes, Eva Šírová.....	320
The Impact and Challenges of The Global Economic Crisis for Achieving Competitiveness of the Selected Company	
Jana Šímanová, Aleš Kocourek.....	330
Readiness of Czech Regions for Industry 4.0	
Lukáš Skřivan, Václav Sova Martinovský.....	339
Usability of Cloud Computing: a Comparison Study Between IT Companies in the Czech Republic and the USA	
Miroslava Vlčková, Petr Zeman, Jiří Alina.....	346
Analysis of the Financial Indicators in the Enterprises Affected by Industry 4.0	
Susann Wiecek, Peter Dorčák, Sven Ludwig.....	353
Adjustments in Business Administration Studies Induced by Industry 4.0	
Alexander Zaytsev, Jiří Kraft, Andrey Zaytsev.....	361
Influence of Implementation of the Lean Production Concept on Development of Market Structures	
Martin Zelenka, Marek Vokoun.....	369
Robotic Process Automation in the Czech Financial Sector	

Section I

Entrepreneurship and Social Responsibility

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Possible Causes of Gender Employment Gap in European Countries

Abstract

Increasing female labour market participation and the equal economic independence of women and men is one of the priorities of the Strategic Engagement for Gender Equality. In 2017 the Gender employment rate of women aged from 20 to 64 (66.5 %) was 11.5 percentage points (pp) lower than that of men aged from 20 to 64 (78.0 %). The largest gender employment gap between men and women was observed in Malta (24.1 pp), Italy (19.8 pp) and Greece (19.7 pp). The aim of the paper is to identify the possible causes of gender employment gap in European Countries. The author chose for the 28 countries' comparison several indicators. Indicators were consulted with employees of several companies in various sectors and were inspired by similar studies in different industries. After choosing the indicators, the multiple linear regression was performed. This method is a very effective method for analyzing relationships between a set of independent variables and one dependent variable. The findings of this research show that the feedback from the supervisor has a big influence on gender employment gap. Based on standardized coefficients, it can be argued that all other independent variables have approximately the same effect on the dependent variable.

Key Words

gender employment gap, Europe, multiple regression

JEL Classification: J16, K38, E24

Introduction

Socially advanced countries in the world are slowly but surely approaching a state where differences disappear in the social status of men and women. Iceland was the most prominent in the rights of gentle half of mankind, who outlawed gender paying this year. Ladies generally gain the privileges they should have always had, but they did not get enough of them in the male society.

If we determine happiness by family and work, it is clear that men generally seek more self-fulfillment at work, while women do not tend to care for much. The average employment rate for European citizens is about 60 % and the figure is changing with regard to the birth of the children.

Women are also far more likely to have family responsibilities to work part-time. To some extent, this is a logical choice, as gentlemen generally make more money across Europe. On average, only 10% leave for paternity leave. Differences between numbers of employed men and women in the Czech Republic could be seen in Tab. 1. There is a time period from the year 1993 to 2017. The employed people (women as well as men) are a

little bit increasing during the period, but there are much more men than women (2.3 mil. women and 2.9 mil. men in 2017).

Tab. 1: Status in employment in the main job in the Czech Republic 1993-2017

		1993	2000	2005	2010	2015	2016	2017	
The employed									
Females	CZ-ICSE group								
		thous. persons							
		2 138.0	2 055.9	2 058.5	2 086.9	2 204.6	2 261.9	2 305.8	
	Employees, incl. members of producers' cooperatives	1.4	2 005.4	1 846.6	1 844.3	1 833.1	1 922.9	1 962.6	2 008.5
	Employers	2	28.9	45.4	41.0	37.4	41.0	36.7	36.3
	Own-account workers	3	94.7	142.9	147.5	194.5	217.6	241.4	241.5
	Family workers	5	9.0	20.9	25.7	21.9	23.1	21.1	19.4
	%								
	Employees, incl. members of producers' cooperatives	1.4	93.8	89.8	89.6	87.8	87.2	86.8	87.1
	Employers	2	1.4	2.2	2.0	1.8	1.9	1.6	1.6
	Own-account workers	3	4.4	7.0	7.2	9.3	9.9	10.7	10.5
	Family workers	5	0.4	1.0	1.3	1.0	1.0	0.9	0.8
Males		thous. persons							
			2 735.3	2 675.4	2 705.4	2 798.2	2837.3	2876.7	2915.8
	Employees, incl. members of produce cooperatives	1.4	2 414.8	2 175.8	2 156.5	2 186.1	2 244.8	2 294.1	2 319.0
	Employers	2	101.6	150.8	136.1	140.6	136.7	124.6	127.5
	Own-account workers	3	213.5	343.2	403.6	463.8	448.6	452.0	463.9
	Family workers	5	5.3	5.6	9.2	7.6	7.2	6.0	5.3
	%								
	Employees, incl. members of produce cooperatives	1.4	88.3	81.3	79.7	78.1	79.1	79.8	79.5
	Employers	2	3.7	5.6	5.0	5.0	4.8	4.3	4.4
	Own-account workers	3	7.8	12.8	14.9	16.6	15.8	15.7	15.9
	Family workers	5	0.2	0.2	0.3	0.3	0.3	0.2	0.2

Source: authors' own, data from (CZSO, 2019)

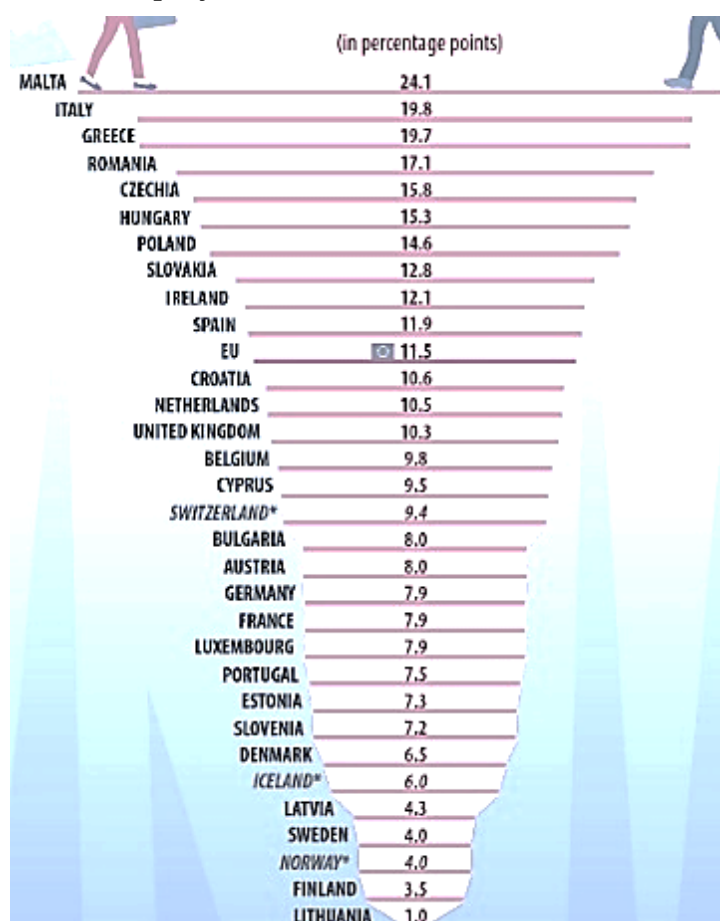
Increasing female labour market participation and the equal economic independence of women and men is one of the priorities of the Strategic Engagement for Gender Equality. This strategy sets the framework for the EU's future work towards gender equality. The other priorities are reducing the gender pay, pension gaps and earnings and thus fighting poverty among women, promoting equality between men and women in decision-making, protecting and supporting victims and combating gender-based violence and promoting women's rights and gender equality across the world.

According to Eurostat (2019) in 2017 the Gender employment rate of women aged from 20 to 64 (66.5 %) was 11.5 percentage points (pp) lower than that of men aged from 20 to 64 (78.0 %), see Fig. 1.

Among the EU Member States, the indicator GEP was the lowest in Lithuania (1.0 pp), followed by Finland (3.5 pp), Sweden (4.0 pp) and Latvia (4.3 pp).

At the opposite side of the ranking, the largest GEP between men and women was observed in Malta (24.1 pp), Italy (19.8 pp) and Greece (19.7 pp).

Fig. 1: Differences in employment men and women across the European Union



Source: Eurostat (2019)

The gender employment gap decreased in the European Union by 0.7 pp, compared with five years ago. From 12.2 pp in 2012 to 11.5 pp in 2017. A decrease was recorded in 16 EU Member States. The aim of the paper is to identify the possible causes of gender employment gap in European Countries.

1. Methods of Research

According to the aim of the paper, identifying the possible causes of gender employment gap in European Countries, the database of Eurostat (Eurostat, 2019) was used. The author chose for the 28 countries' comparison several indicators. The selection of indicators was held to be not distorted subjective opinion of the author. Indicators were consulted with employees of several companies in various sectors and were inspired by similar studies in different industries. In the end, such indicators were selected for which data were sufficient and could have an impact on gender employment gap (see Tab. 2 with countries and indicators).

Tab. 2: Basic Eurostat data regarding to working conditions for employees

Country	Working hours	Good relationships	Commuting time	GPG	Training	Feedback from supervisor	GEG
Austria	36.6	73.2	39.6	22.2	43.8	71.3	8
Belgium	37.1	77.0	48.2	6.6	47.7	69.5	9.8
Bulgaria	40.8	85.7	33.4	14.2	15.9	82.4	8
Croatia	39.5	74.7	37.9	8.7	26.1	70	10.6
Cyprus	39.5	84.7	22.4	14.2	22.9	77.2	9.5
Czechia	40.5	68.3	35.7	22.5	52.9	72.4	15.8
Denmark	33.5	85.1	48.3	16.0	38	70.5	6.5
Estonia	38.6	77.3	42.2	28.1	49.2	67.1	7.3
Finland	36.8	83.9	48.5	18.4	55.2	69.6	3.5
France	37.2	70.4	44.9	15.5	40.8	66.6	7.9
Germany	35.2	67.4	45.3	22.3	41.7	66.1	7.9
Greece	42.2	83.3	32.6	12.5	8.8	78.1	19.7
Hungary	39.8	80.6	43.5	15.1	25.5	68.8	15.3
Ireland	35.9	88.6	48.4	13.9	50.9	74.5	12.1
Italy	37.0	46.5	28	6.1	30.4	69.9	19.8
Latvia	39.0	68.3	48.9	17.3	34.1	66.5	4.3
Lithuania	38.3	79.8	34.4	13.3	33.8	62.6	1
Luxembourg	37.4	78.7	45.2	5.4	49.2	68.3	7.9
Malta	38.5	88.0	43.4	10.6	38.4	80.1	24.1
Netherlands	30.1	77.0	45.1	16.1	50.5	71.4	10.5
Poland	40.7	55.5	35.7	7.7	35.5	76.6	14.6
Portugal	39.4	78.3	25.4	14.9	26	72.9	7.5
Romania	39.8	75.3	40.3	4.5	19.2	72.7	17.1
Slovakia	40.2	66.0	34.1	19.7	47.2	69.7	12.8
Slovenia	39.3	80.7	39.9	7.0	43.2	75.2	7.2
Spain	37.8	83.6	36.8	14.9	32	71.4	11.9
Sweden	36.3	71.5	50	13.8	45.4	60.9	4
United Kingdom	36.7	82.4	52.5	20.9	50.6	73.6	10.3

Source: authors' own, data from (Eurostat, 2019)

Indicator „Working hours“ is an average number of usual weekly hours of work in main job, by sex, professional status, full-time/part-time and economic activity. „Good relationships“ is a percentage of employed persons having a good relationship with their colleagues by sex and age. „Commuting time“ means a mean duration of commuting time one-way between work and home by sex and age (in minutes). „GPG“ is Gender Pay Gap in unadjusted form by NACE activity – structure of earnings survey methodology in percentage. „Training“ is a percentage of employed persons participating in job-related non-formal education and training in the past 12 months by sex and age. „Feedback from supervisor“ means a percentage of employees receiving regular feedback from their supervisor by sex and age. And finally „GEG“ is a Gender Employment Gap, which is defined as the difference between the employment rates of men and women aged 20-64. The employment rate is calculated by dividing the number of persons aged 20 to 64 in employment by the total population of the same age group. It is based on the EU Labour Force Survey.

The indicator GEG is a part of the European Union Sustainable Development Goals (SDG) indicator set. It is used to monitor progress towards SDG 5 on gender equality. In order to promote women’s social and economic empowerment, SDG 5 calls for, among other things, recognition and value of unpaid care and domestic work, technology, basic and financial services, equal rights and access to economic and natural resources, and property. GEG is included as main indicator in the Social Scoreboard for the European Pillar of Social Rights as well.

After choosing the indicators, the multiple linear regression was performed. This method is a very effective method for analyzing relationships between a set of independent variables and one dependent variable.

In a multiple regression-based analysis, we look for variable-dependent values from a linear combination of several (two and more independent variables). The calculation formula is similar to simple regression (Yan and Su, 2009):

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 \quad (1)$$

Y is a dependent variable whose values we try to predict, a is a constant, values b1, b2, b3 are regression coefficients (also called partial regression coefficients) and X1, X2, X3, are independent variable values.

2. Results of the Research

The data were processed by the statistical software IBM SPSS Statistica 22. It was found that less than 33 percent of the variable variable variability is explained by the variability of the independent variable (see Fig. 2).

Fig. 2: Model Summary

Model Summary ^b									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,672 ^a	,452	,327	4,4030	,452	3,624	5	22	,015

a. Predictors: (Constant), Feedback from supervisor, GPG, Good relationships, Training, Commuting time

b. Dependent Variable: GEG

Source: authors' own

The significance P value is nonzero, so we reject the hypothesis. R square is therefore statistically insignificant (see Fig. 3).

Fig. 3: ANOVA Analysis

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	351,254	5	70,251	3,624	,015 ^b
	Residual	426,507	22	19,387		
	Total	777,761	27			

a. Dependent Variable: GEG

b. Predictors: (Constant), Feedback from supervisor, GPG, Good relationships, Training, Commuting time

Source: authors' own

The most important results bring the table of coefficients (Fig. 4). Each coefficient is statistically significant, it means nonzero. Based on standardized coefficients, it can be argued that all independent variables have approximately the same effect on the dependent variable. The biggest influence has the feedback from the supervisor.

Fig. 4: Coefficients' Results

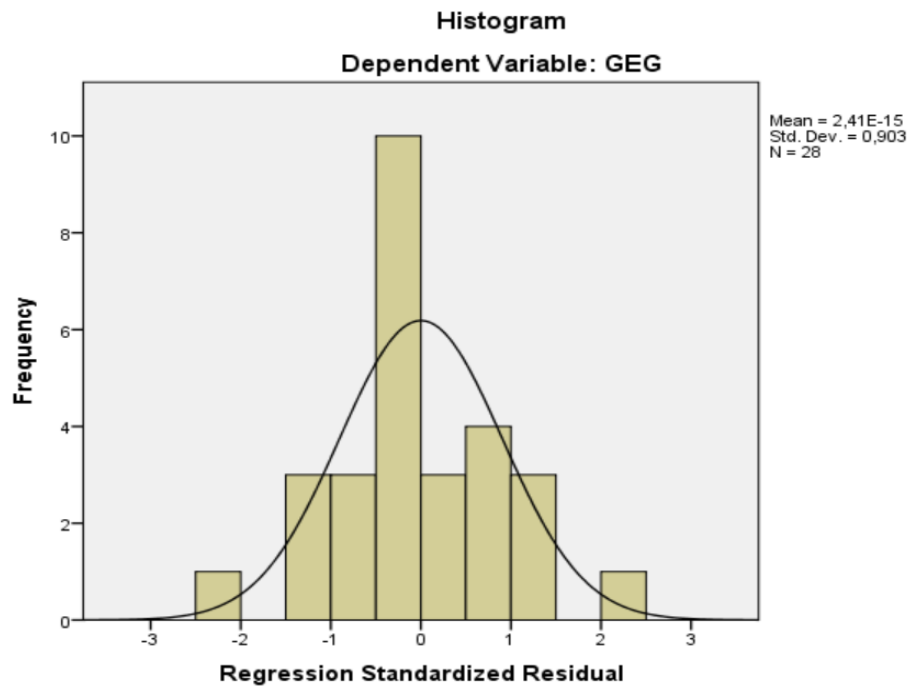
Coefficients ^a					
Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	Std. Error	Beta	
1	(Constant)	-25,012	16,355		,140
	Good relationships	-,225	,104	-,402	,042
	Commuting time	,110	,152	,160	,476
	GPG	-,089	,159	-,098	,584
	Training	-,058	,095	-,133	,545
	Feedback from supervisor	,725	,212	,662	,002

a. Dependent Variable: GEG

Source: authors' own

The histogram shows that residues have approximately normal distribution (see Fig. 5).

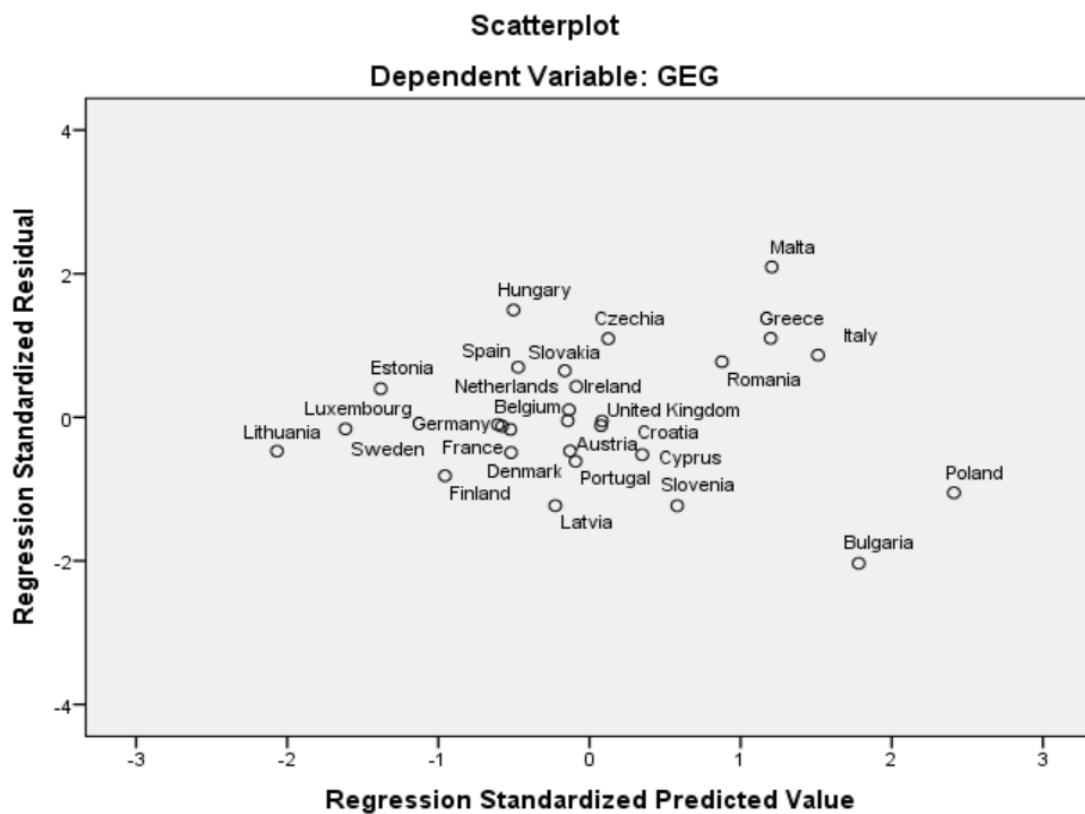
Fig. 5: Histogram Results



Source: authors' own

In scatterplot (see Fig. 6) we give standardized predicted values on the x-axis and standardized residues on the vertical axis. Points should be randomly spaced in this graph type.

Fig. 6: Scatterplot Results



*Source:
authors' own*

3. Discussion

There is no similar research in this field focusing of possible causes of gender employment gap in European countries. Hedija (2015) studied the gender wage differences and came to the conclusion that women's wages increase relative to male wages as the proportion of female employees grows. Also Redmond and McGuinness (2019) and also Galbraith et al. (2019) studied the gender wage differences.

A lot of authors examined the gender gap, for example Huffman et al. (2017), Nita (2019), Petrongolo (2019), Van der Lippe et al. (2018) and Činčalová (2016). Huffman et al. (2017) showed through the UQR models that the policies assumed to reduce gender inequality, but they have a much stronger effect near the bottom of the wage distribution. Their findings also clearly demonstrate that it is low-wage workers who benefit most from policies that formalize personnel systems and explicitly promote female employees in their workplaces.

Gender inequalities in the new world of work were described by Piasna and Drahokoupil (2017). These authors found that traditional gender inequalities continue to reaffirm themselves on many dimensions, also despite the profound changes in the labour market. With standard employment declining in significance, the policy challenge is to include new forms of work in effective labour protection frameworks that promote equal access of women and men to quality jobs and their equal treatment at work.

The gender wage gap in Turkey was researched by Tekguc et al. (2017) and gender wage gap in formal and informal jobs in urban Brazil by Yahmed (2018). Yahmed (2018) studied how gender inequality differs across informal and formal wage-earners in urban Brazil. The raw gender wage gap is about the same on average in informal jobs (5%) as in formal jobs (7%), but the author shows that this difference is the result of different male and female selection processes. For example female employees have better observable characteristics than male employees, for instance in terms of educational attainment.

Conclusion

Gender gaps are one of the most pressing challenges in today's world life. The gender employment gap decreased in the European Union by 0.7 pp, compared with five years ago. From 12.2 pp in 2012 to 11.5 pp in 2017. A decrease was recorded in 16 EU Member States. The aim of the paper was to identify the possible causes of gender employment gap in European Countries. For this purpose a few indicators were chosen according to the Eurostat.

Using the SPSS Statistical programme, each indicator is statistically significant. It was found that less than 33 percent of the dependent variability is explained by the variability of the independent variable. Based on standardized coefficients, it can be argued that all independent variables have approximately the same effect on the dependent variable. The biggest influence has the feedback from the supervisor.

The paper extends and complements findings various studies in this field. This topic deserves a future research and there is a great field for potential researchers. Further experimental investigations are needed to estimate.

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Creativity within boundaries: Social identity and the development of new ideas in franchise systems

Abstract

This paper deals with the topic of creativity and perceived freedom of creativity in international franchising business concepts. It analyses various areas of daily business operations and the franchising business concept as a whole. Its focus is aimed at comparing the perception of level of freedom given in these areas to franchisees by the franchisors and its objective is to find out where these perceptions differ between franchisees one side and franchisors on the other. The model of franchising is not described and the article assumes that the reader is familiar with this business model. The purpose of this article is to analyse and present the situation of creativity in the sector of international franchise businesses. As international franchising is in the focus of this article, topics such as cross-cultural environment in franchising models and creativity across cultures are covered. The method used to collect the data for further analysis is running an empirical research among two populations – franchisees and franchisors from several franchising business concepts active in international environment. Representatives from the two populations were asked to evaluate the level of freedom of creativity given or applied in their franchising business concepts. Respondents were answering an online survey, assessing ten different areas in daily business on a scale from one to five, ranging from no creativity allowed and strict governance by rules defined in the franchise concept to high level of creativity and freedom. Findings from both side of the franchise business partnerships, franchisees and franchisors.

Key Words

franchise, social identity, network, new age

JEL Classification: C21, R13

Introduction

A well-established strand of research on creativity examines the influence of social context on the ability of individuals to propose new ideas (Ford, 1996; Nemeth & Staw, 1989; Shalley & Gilson, 2004). Creativity, defined as the generation of new ideas as well as the assessment of those ideas to be included in a domain, is then considered as the result of social processes among individuals (Csikszentmihalyi, 1996; Runco, 2010). It is widely recognized that creativity is fostered in environments that encourage risk-taking, individual autonomy and change (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Andriopoulos, 2001; Ford, 1996). In contrast, conformity and uniformity are traditionally perceived as constraints for new idea generation (Andriopoulos, 2001; Nemeth & Staw, 1989). In fact, conformity, defined as “the act of team members changing their behaviours to promote and express team unity” (Kaplan, Brooks-Shesler, King, & Zaccaro, 2009, p. 232), relates to complying with prevailing and existing standards, attitudes and practices,

whereas creativity is associated with the development of variations (Breslin, 2012). In organizations that have a strong orientation towards conformity and promote control, individuals cannot make divergent decisions because of group pressure (Amabile, 1988; Chirumbolo, Areni, & Sensales, 2004; Nemeth & Staw, 1989). These organizations also tend to pressure individuals to replicate traditional schemes to solve new problems (Breslin, 2012).

However, another perspective is proposed by more recent works that emphasize the positive effects of conformity for idea implementation (Goncalo & Duguid, 2012; Miron-Spektor, Erez, & Naveh, 2011). Because ideas need to be accepted by multiple audiences during the creative process (Cattani, Ferriani, & Allison, 2014; Csikszentmihalyi, 1996; Ford, 1996), compliance with previous customers' frames of reference and compatibility with the existing organizational structure and processes facilitate the positive assessment of new ideas (Kaplan et al., 2009; Miron-Spektor et al., 2011). Certain sectors have enhanced the uniformity of practices and currently need to reinvent their practices and offerings (Blake & Burkett, 2017). Thus, these sectors need to reinforce the competing logics of creativity and conformity. For example, healthcare organizations need to control variation to ensure the reliability of their operations (Berwick, 1991) while simultaneously embracing change due to new technologies. Other sectors, such as the food industry, emphasize standardization and norms to achieve economies of scale and give consumers confidence in their offerings (Whitelock & Pimblett, 1997). However, those companies still need to foster their employees' creativity to differentiate themselves from their competitors. Creative organizational mechanisms have mainly been studied in environments such as design firms (Hargadon & Sutton, 1997), R&D laboratories (Ettlie & Elsenbach, 2007) and the cultural industry (Cohendet & Simon, 2007; DeFillippi, Grabher, & Jones, 2007), which demand a high level of novelty. In contrast, less attention has been paid to contexts in which creativity is highly channelled and controlled.

This research aims to understand how different types of identities impact the creative process in terms of novelty generation and conformity. Managers can manipulate individuals' perceptions of a shared identity to support innovative behaviours (Caldwell & O'Reilly, 2003). Thus, we propose that the social identity perspective, which aims to understand how individuals form shared meaning in groups and how identities guide behaviours, provides an interesting framework to resolve the tension between conformity and the generation of new variations. This perspective holds that organizations are structured groups and that people derive their identity from the groups to which they belong (Tajfel, 1972; Turner, 1975, 1982). Consequently, through the process of depersonalization, which arises in groups with a salient identity, individuals align their perceptions and behaviours with prototypes of the group or its sets of ideal characteristics.

Few studies have investigated how identification with a group affects the emergence and acceptance of new ideas (Adarves-Yorno, Postmes, & Haslam, 2007; Haslam, Adarves-Yorno, Postmes, & Jans, 2013; Hirst, Van Knippenberg, & Zhou, 2009; Swann, Kwan, Polzer, & Milton, 2003; Tang, Shang, Naumann, & Zedtwitz, 2014). Strong identification with the group leads an individual to persist in the face of failure and to desire to take on challenges, which fosters the emergence of new ideas (Hirst et al., 2009) and enhances the acceptance of ideas from the ingroup (Adarves-Yorno et al., 2007; Haslam et al., 2013). Because most previous works are either conceptual or experimental (for exceptions, see

Hirst et al., 2009; Tang et al., 2014), we lack an understanding of the impact of identity on creativity in organizations. To better understand this issue, this paper differentiates between two identities that prevail in organizations—organizational and expertise identities—which have different impacts on creativity (Tang et al., 2014). It then aims to develop deeper insights into the way different types of identities impact the creative process in terms of both novelty generation and conformity. We conduct our study in the specific context of franchise systems. In such context, different identities intertwine (Ullrich, Wieseke, Christ, Schulze, & Van Dick, 2007). Furthermore, franchisors need to find a balance between maintaining uniformity within the system and enhancing new idea deployment for adaptation (Bradach, 1998; Szulanski & Jensen, 2008). We demonstrate that the trade-off between creativity and conformity can be resolved by enhancing certain forms of organizational identity focused on entrepreneurship or an expertise identity, which encourages learning.

This article is organized as follows. In the section 2, we review the relevant literature on the social identity perspective and creativity as well as the particularity of the unfolding of creativity in franchise systems. Section 3 presents the research methodology. The results of the empirical study are presented and discussed in section 4.

1. Literature Review

1.1 The influence of social identity on both creative idea assessment and generation

The majority of articles on creativity focus exclusively on the generation of new ideas. In contrast, the process by which an idea becomes accepted in social circles has received less attention (Cattani, Ferriani, & Colucci, 2015). In this paper, we acknowledge a social conceptualization of creativity that presupposes that creativity is developed through the interactions between a producer and different audiences (Ford, 1996). We refer to the work of Csikszentmihalyi (1996), which describes the creative act as the introduction of novelty to a field by creative persons and the positive responses of gatekeepers, who are representative of the field, in evaluating creativity. Thus, the creative process may appear to involve divergent processes because it involves both the embeddedness of the idea in the standards of evaluation of the field and the departure from those standards (Cattani et al., 2015). Creators usually communicate with gatekeepers to understand their requirements and to test their own ideas (Glăveanu & Lubart, 2014). Gatekeepers establish constraints and guide creative behaviour. These outside “social influences are not external to the creator but shape the dynamics of creativity from ‘within’” (Glăveanu & Lubart, 2014, p. 38).

A shared social identity among gatekeepers and creative people positively influences the acceptance of new ideas. Thus, Adarves- Yorno and her co-authors (Adarves-Yorno, Postmes, & Haslam, 2006; Adarves-Yorno et al., 2007; Haslam et al., 2013) have developed a research programme to assess the influence of group identification on creative assessment. They particularly focus on ingroup favouritism, which emerges from social identity salience (Hogg & Terry, 2000; Turner, 1975, 1982). In their works, Adarves-Yorno et al. (2006, 2007) differentiate between social and personal identity and test their

influence on both idea generation and evaluation. Their pioneering approach applies the social identity perspective to creativity. It derives from the assumption that the assessment of an idea as creative is not a property of an object but emerges from a social consensus in reference to current norms. Individuals forge their identity from perceived membership in relevant social groups, and these perceived memberships explain both behaviour vis-à-vis the ideas of members of the ingroup and the ideas from members of the outgroup. Social categorization and depersonalization lead individuals to assimilate the self into the ingroup prototype and internalize norms of appropriate behaviour. Perceptions and evaluations are then shared with members of the ingroup. Because social identity is salient, individuals are more likely to propose new ideas that are in line with ingroup norms (Adarves-Yorno et al., 2007). They will also consider the ideas of others to be creative as long as they are consistent with those norms.

In another set of experiments with students, Adarves-Yorno et al. (2006) demonstrate that social identity leads individuals to perceive ideas as more creative when they come from an ingroup member than when they come from an outsider. Thus, norms influence both the creative person's ability to deviate from existing practices and judgement concerning the creative object (Adarves-Yorno et al., 2007). As stated by Adarves-Yorno et al. (2006), group norms determine what is perceived as creative. Norms may both guide creativity and constrain it. For example, Adarves-Yorno et al. (2006) show that non-innovative ideas may be judged to be creative when the norms of the group are conservative. The conclusions of these sets of experiments also demonstrate that outsiders can manipulate individuals' practices and can influence what is considered creative (Adarves-Yorno et al., 2007). These studies also shed new light on the relationship between conformity and creativity. Creativity may be curbed to conform to group norms, but it can also challenge those norms and transform them.

Several researchers have also studied the influence of team identity on the assessment process, albeit with mixed results. Janssen and Huang (2008) found no positive impact of team identity on middle managers' creativity. In groups with a high level of social attraction, members may be attracted by prototypes that promote suboptimal decision-making processes and constrain every type of deviation from routine behaviours (Hogg & Terry, 2000; Janis, 1982). This behaviour, which is called groupthink, can be avoided if the norms of the group support risk-taking and embrace people's unique identities. Thus, several researchers propose that groups that have a strong identity and that value the unique qualities of each individual are likely to facilitate the generation of new ideas, whereas groups that undervalue the differences among individuals may impede the generation of variations (Haslam et al., 2013; Janssen & Huang, 2008; Swann et al., 2003). Furthermore, processes that lead to creative outcomes are encouraged by team identification characteristics such as persistence, task ownership and a positive outlook (Hirst et al., 2009). Team identification also increases inter-team cooperation (Richter, Van Dick, & West, 2004), positive ingroup attitude and cohesion (Hogg & Terry, 2000).

Thus, the facilitation of both the generation of new ideas that deviate from existing practices and the positive evaluation of those ideas relies on a strong identification with groups with norms that value individuals' qualities and new insights. The main challenge for managers lies in manipulating identities as well as group norms to increase creative outcomes. Experiments such as those conducted by Adarves-Yorno et al. (2006, 2007) and Haslam et al. (2013) demonstrate that norms of appropriate behaviour can be

transformed. In particular, group identity can be altered through changes in the salience of the relevant intergroup comparative context. Furthermore, individuals can possess more than one social identity (Ullrich et al., 2007), and a leader can attempt to increase the salience of the identities that better fit with creative behaviours.

Two main forms of social identification are relevant in companies: organizational identity (OI) and expertise identity (EI) (Tang et al., 2014). EI is defined as the component of identity that is related to the job or task content. This concept has been overlooked in empirical studies (Tang et al., 2014), whereas OI has received considerable attention in organization studies (He & Brown, 2013). The latter concept refers to an entity's attempt to define itself (Corley et al., 2006, p. 87) and is related to a firm's culture, history, structure, characteristics, status and reputation (Martin, Johnson, & French, 2011). It involves a shared meaning regarding what is distinctive to an organization and defines what is important at work for individuals (He & Brown, 2013). The impact of OI on creativity has been questioned by several authors (Hirst et al., 2009; Madjar, Greenberg, & Chen, 2011; Tang et al., 2014). It initially seems that because OI encourages individuals' involvement in their tasks as well as the alignment of personal and organizational interests, it should positively influence creativity (Hirst et al., 2009). However, in environments with a high level of conformity, employees comply with established practices to ensure acceptance (Madjar, Greenberg, & Chen, 2001). Consequently, it has been demonstrated that OI fosters incremental creativity but has no impact on radical creativity (Madjar et al., 2011). In environments with a high level of conformity, employees are encouraged to find creative solutions that adhere to rules and processes.

The relationship between EI and creativity seems to be more straightforward. EI has been demonstrated to increase new idea generation for R&D staff (Tang et al., 2014) as well as variation among scientists (Swann et al., 2003). EI drives experts' intrinsic motivation and encourages them to share knowledge with their peers and find new solutions (Swann et al., 2003; Tang et al., 2014). It also enhances communication within groups. However, the underlying mechanisms of these two identification processes to drive or constrain creativity in routine environments have not yet been explored (Madjar et al., 2011). In such environments, there may be tensions between the different types of identities, which do not value the same behaviours.

One context is particularly relevant to illustrate these tensions: franchise systems. Franchise systems have been studied to highlight the interplay of different levels of identities within the same organization (Lawrence & Kaufmann, 2011; Ullrich et al., 2007; Watson, Dada, Grünhagen, & Wollan, 2016; Zachary, McKenny, Short, Davis, & Wu, 2011). Shaping social identity is one of the main ways for franchisors to control their franchisees' behaviours; they rely on social control to reduce the risk of franchisees engaging in free-riding (Shane, 1998; Ullrich et al., 2007). Franchisors face a particular challenge: as most franchise concepts are maturing in developed countries (Hoffman & Preble, 2004), franchises must innovate to maintain their sustainability. However, franchisees still need to maintain conformity with the franchise's core concept to ensure diffusion into the network of franchisees and maintain their differentiation (Kaufmann & Eroglu, 1999).

1.2 The specificities of the franchise system in terms of creativity

Business format franchising relies on collaboration between a franchisor and franchisees who are legally and financially distinct small business owners. The franchisor provides the franchisees with a brand name and a concept and is responsible for the marketing strategy and intellectual property (Shane, 1996). Franchisees are a valuable source of new ideas as they adapt products and concepts to the needs of local clients (Frazer, Mirrilees, & Wright, 2007). Several empirical works have demonstrated that franchisees are thus important sources of new products, services or processes (Clarkin & Rosa, 2005; Cox & Mason, 2007; Dada, Watson, & Kirby, 2012; Grünhagen & Mittelstaedt, 2005; Watson et al., 2016).

However, franchisees need to comply with a standardized framework to protect the franchise's identity (Dada et al., 2012). This standardized framework may be a core element of OI. Allowing franchisees the unlimited pursuit of new and interesting problems can damage the franchise network unless the problems directly address organizational objectives and OI. Although franchisees may propose better ideas in the long run, they may harm the reputation of the franchise's brand. The difficulty therefore lies in managing the balance between creative freedom and system uniformity. Thus, franchisors implement franchisee-developed ideas only when these ideas do not undermine the uniformity of the system (Cox & Mason, 2007). Franchisees are business owners who risk resources to develop a local market, and they have a financial interest in the development of the business (Kaufmann & Dant, 1999). Furthermore, they have autonomy in managing their outlet (Grünhagen, Wollan, Dada, & Watson, 2014). However, franchisors have a strong interest in shaping the OI of the franchise to guide franchisees' behaviours and ensure conformity within the networks without exercising coercive pressure (Ullrich et al., 2007). Consequently, several authors have questioned the status of franchisees as entrepreneurs or quasi-employees (Bradach & Kaufmann, 1988; Stanworth, 1995). On one end of the continuum, franchisees can be considered independent (Stanworth, 1995), and one of the components of the EI of franchisees is an entrepreneurial orientation that entices them to take risks (Dada & Watson, 2013). Such an orientation is favourable to introduction of novelty into the market (Croonen, 2012). Depending on the activity of the franchise, franchisees can also develop specific knowledge or practices as they grow their business and transfer these into the system (Szulanski & Jensen, 2006). Because franchisees often receive feedback from other franchisees (Dada et al., 2012) and can communicate freely through the implementation of a franchisee council at the regional or local level (Lawrence & Kaufmann, 2011; Watson et al., 2016), they may foster a strong identity based on the expertise required in their everyday tasks. An EI can then become salient in the network.

On the other end of the continuum, franchisors may attempt to align decision-making among franchisees with their own interests through OI (Zachary et al., 2011). In these instances, they develop rhetoric and attempt to attract franchisees who have similar values and objectives as their own (Zachary et al., 2011). OI may also promote innovations within the network. For example, Clarkin and Rosa (2005) demonstrate that although franchisors may focus on maintaining uniformity within the network, certain franchisees collaborate with the franchisor. In those instances, contractual agreements are not strongly enforced, and franchisees are granted the latitude to propose new products (Chanut & Paché, 2011). However, OI is especially influential in enhancing the broad

diffusion of an idea through the network (Hirst et al., 2009). Hence, franchisees are simultaneously the creators and the audience. The literature particularly highlights the influence of multiple unit franchisees who can pressure franchisors to adopt innovations or change practices (Weaven, 2004). Sometimes, particularly for organizational innovations, franchisees need to invest to deploy the new idea in their own outlet. Consequently, to ensure the uniformity of the offering throughout the network, the franchisor must rely on social control (Shane, 2001). In the specific case of creativity, we propose that it can foster positive assessments of new ideas and thus the perception that the idea either comes from the ingroup or fits with the group's norms.

The literature review provides insights into the fact that both EI and OI can impact the idea generation and assessment processes. However, these identities may also conflict because EI that conforms with entrepreneurial norms may lead to substantial deviations from the franchise's core concept, whereas an OI that aims solely to enhance the concept's conformity will constrain any form of entrepreneurship. Consequently, we conduct a comparative analysis of different franchise systems to understand how different types of identities impact the creative process in terms of novelty generation as well as conformity.

2. Methodology

In this research project, we compare cases of idea generation and diffusion to draw new theoretical insights (Eisenhardt, 1989; Miles & Huberman, 2003). We adopt a qualitative approach based on 20 narrations of the unfolding of creative ideas within 17 franchise systems. This approach, complemented by comparative case studies, is particularly appropriate to understand the social practices related to organizational creativity (Fortwengel, Schüßler, & Sydow, 2017).

We conducted 18 interviews with senior members of different franchise networks (founders, managing directors, network directors, sales directors and heads of development) and franchisees to understand the franchise context. We chose to maximize the variations of the context to take into account different situations. The respondents represented networks of varying ages (some have been in existence for less than five years, while the oldest has existed for more than 50 years), varying sizes (from fewer than 10 units to more than 400 units) and varying structures (some networks are mixed, while others are dominated by company-owned units and still others are fully franchised), as described in Table 1.

Tab. 1: Characteristics of the 17 franchises

Franchise systems' characteristics	Number	Frequency
<i>Age of franchise system</i>		
Less than 5 years	1	
6-10 years	3	
11-15 years	1	
More than 15 years	12	
Total	17	100%
<i>Size of franchise system (company owned and franchised)</i>		
1-50 units	8	47%
51-100 units	2	11.8%
100-150 units	3	17.6%
More than 150 units	4	23.5%
Total	17	100%
<i>Industry sector</i>		
Construction	2	11.8%
Retail	4	23.5%
Hotels and restaurants	3	17.6%
Services to individuals	3	17.6%
Automobile services	2	11.8%
Business services	3	17.6%
Total	17	100%

The semi-structured interviews were conducted in a face-to-face manner via telephone or Skype. They lasted an average of 45 minutes. Our interviews comprised three different parts. The first part dealt with assessing the general context of the franchise and the processes implemented to manage innovation. During the second part of the interview, we asked the interviewees to relate narrations of new ideas that emerged in the network and of the adoption of those ideas in the network. We asked further questions regarding the origins of the idea, the impediments to its deployment and the actions taken by different actors in the network (the creative persons, other franchisees and the franchisor).

Our focus on the descriptions of real cases in the interviews limits bias (Amabile & Kramer, 2011). Descriptions of these creative processes allowed the researchers to assess whether the idea was adopted or rejected by the audience (other franchisees). We asked each interviewee to detail the process of one idea that was adopted in the network and another that failed to diffuse. Finally, we concluded with questions regarding turnover within the franchise system and details on the profile of franchisees and communications

among franchisees and between franchisees and the franchisor. These questions allowed us to assess the franchise's main characteristics of identification.

In addition, we participated in a conference on innovation in franchise systems and gathered three narrations from managers working in franchise systems. Because we had previously interviewed other members of those franchises, this allowed us to crosscheck information. These comparisons were particularly insightful because they contrasted franchisors with different identities. These franchisors showed different perspectives in their discourses, which reflected a divergence in the ideation process in these franchise systems.

We collected secondary data on each network, including videos of the human resources departments describing their expectations for future franchisees and testimonials of franchisees explaining the reasons why they chose a particular franchise. We also compiled press releases on examples of innovations deployed in the networks under study as well as articles highlighting tensions inside the franchise network.

The transcripts were coded to enable a thematic content analysis (Miles & Huberman, 2003) using NVivo. We first assessed how members of the franchise system define their identity. We acknowledge that OI and EI may overlap and that there may be different degrees of identification.

We coded elements related to EI as actors referring to themselves as belonging to a particular job category and emphasizing unique know-how related to a task. We identify this identity as salient when actors recognize that they often meet and communicate with people who they perceive as having the same expertise and that perceived expertise shapes behaviours.

We coded elements related to OI as actors referring to themselves as belonging to a group with a strong brand name or having common know-how in relation to the concept of the franchise. Rhetoric has been used to assess OI in franchises, and we use the same method as that described in Zachary et al. (2011). We identify this identity as salient when the actors recognize that the norms and values of the organization shape their behaviours.

We assessed whether a franchise had a high or low level for each identification type through their use of words such as “strong” and “long-standing”. Table 2 describes the key words that were used to identify the presence/absence of each type of identity as well as their intensity.

We then drew a map (Figure 1) with four dimensions: low versus high organizational/expertise identification. We positioned the franchise systems on that map. We identified six categories of franchises. For each group, we identified the mechanisms underlying idea generation and acceptance by analysing the narrations in relation to the unfolding of new ideas in the different systems. We described each group with a label, which is shown in Figure 1. This label reflects the main meaning of the interviews in terms of the franchisors' perception of the franchise network.

Tab. 2: Characterization of the different types of identification and their level

Type of identification and level	Definition	Key Words	Example of verbatim
EI	Defined as a group of individuals sharing the same know- how to perform a task or job	The same job, similar expertise Look specifically for a type of profile that relates to a functional job (such as a sales person), business logic	“It is based on the fact that we are all doing the same job” (Franchisor, automotive industry).
OI	Defined as a group of individuals with a shared meaning of what is distinctive in the organization	Strong brand, charismatic leader (Zachary et al., 2011), try to attract people from different types of profiles and jobs	“The franchise had a strong identity, and today they are thinking about their identity by organizing a brand challenge and reflecting on their values, which is one of the fundamentals” (Franchise in the food industry).
High level	The identification is strong	Strong culture, long tradition	“It is also part of our long- standing and strong culture of exchange” (Franchisor in the automotive industry).
Low level	The identification is low	Weak identity and culture	“The model of franchise, as we designed it in 2006, is no longer a viable model” (Franchisor in the construction industry).

3. Results and Discussion

The comparisons of the processes related to idea generation and acceptance show differences among our six categories. We find that where EI is prevalent, the idea is presented as coming from the ingroup to encourage its acceptance, whereas franchise systems that focus more on OI attempt to search for new ideas outside the franchise network (from partners, customers or suppliers) or prefer ideas from franchisees who had previous experience in other fields and transferred their knowledge (Table 3).

The ideas that are accepted are those that have the highest return on investment. In the next section, we detail further differences among franchise systems according to the social identity that prevails in the network. For each category, we first describe and discuss the results. Then, we conduct a cross-category analysis.

3.1 Description and analysis

3.1.1 A hierarchical community (high OI and low EI)

The franchise systems belonging to this group are well-established organizations with a strong brand and are among the leaders in their market. The network size comprises at least 100 franchisees, which can eventually form a franchisee's council to have their voices heard. Franchisees join these franchises to benefit from their reputation and attract customers thanks to the franchise's brand as well as to profit from its well-refined processes.

These franchises have a well-structured process to gather new ideas from franchisees. They select new ideas by a small committee, which may involve a few franchisees. One of the main focuses for the franchise management team is to avoid the informal spread of negative practices within the network. Consequently, they require franchisees to report each new practice for assessment. The following verbatim comments illustrate the focus on maintaining the uniformity of the core concept:

We communicate one [best practice] every week, and the aim is to find as many as possible. We only disseminate the good ones, but we also talk about the bad ones [bad new solutions]. There are a lot of people who tell us about [ideas for] best practices that could be best practices but that stray from the core concept and are risky in terms of franchise approval. So we tell them it is a bad practice. (Case O)

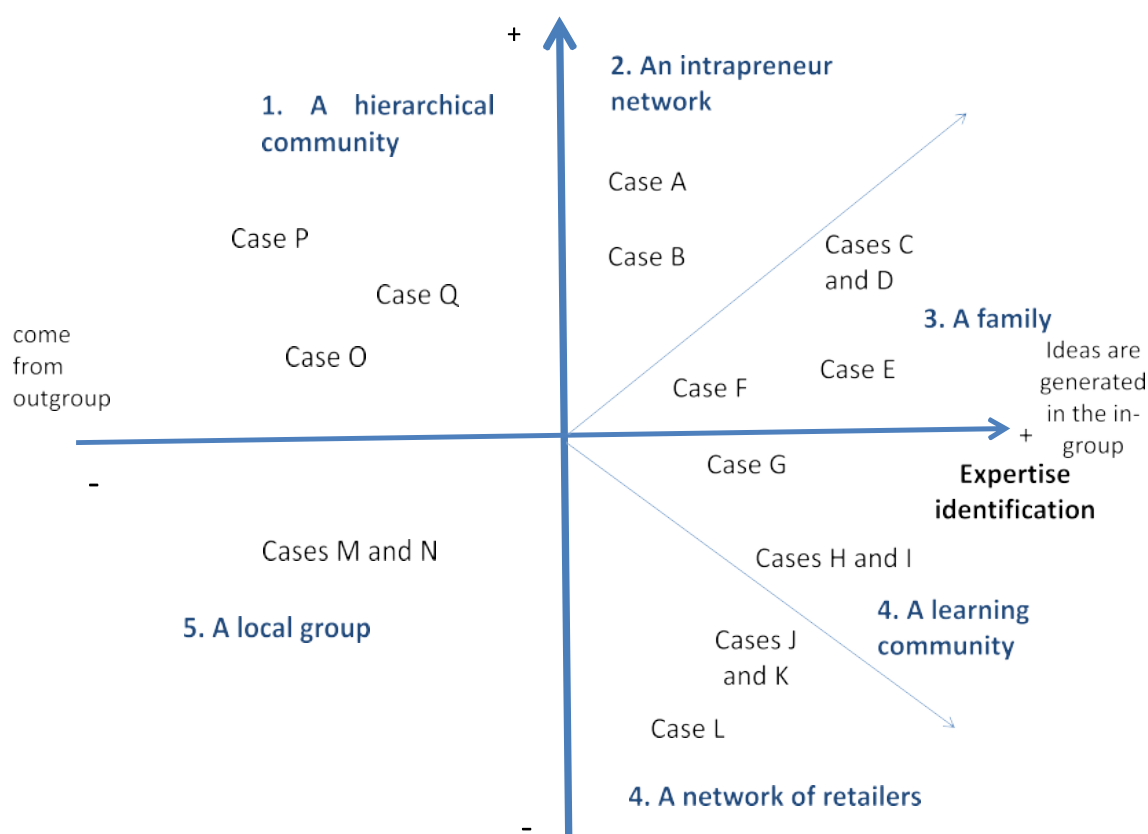
Competition among franchisees is fostered as challenges which are organized to entice them to search for new solutions. Rewards can then be distributed during the annual conference. This increases the communication flow from franchisees to the head of the network instead of among the franchisees. The following verbatim comments highlight the institutionalization of an innovation process as well as the focus on bottom-up information streams.

We set up what we call the “Innovaction” cell, which enables innovations or ideas that emerge on the ground to be communicated to the top. – And they either come from branches or the franchisees? Exactly ... every 2 years ... in the form of a competition. (Case Q)

Ideas are mostly considered to be coming from the outgroup (from actors such as the franchisor, who is perceived as not belonging to the ingroup) as they are diffused by the committee. Consequently, franchisors may have difficulty spreading new practices. In these instances, they emphasize the financial benefits related to innovation and, more particularly, the short-term return on investment. One of the franchises has even established a specific budget to help franchisees invest in the deployment of innovations. To foster OI and entice franchisees to adopt an innovation, franchisors also rely on external communication. They promote the innovation by creating events with strong visual impact for both customers and franchisees. For example, case O, a service franchise, designed a specific suit that its franchisees can wear to experience what an elderly person must endure: earphones are used to simulate buzzing in the ears, glasses lead to blurred vision, and belts simulate arthritis. Numerous press articles were published. The suit was

initially designed to train franchisees. However, currently, managers working in case O suggest that clients caring for elderly persons should wear the suit so that they can understand the persons for whom they are responsible. Showcasing the innovations realized within the network can have several impacts. Franchisees feel that their franchise's concept differs from that of other franchise systems in the same industry. The franchise's concept is also perceived as more attractive because of the substantial communication about the innovations. OI is thus enhanced as the franchise's identity becomes more salient and the new idea is perceived to fit with the group's prototype, which facilitates its adoption.

Fig. 1: Mapping of the 17 franchise systems according to their type of identification



Colour figure can be viewed at wileyonlinelibrary.com

This configuration allows for new idea generation and selection in conformity with the franchise's concept. However, it may lead to tension within the network as the franchisor imposes the adoption of a new idea to maintain uniformity in the network and uses mostly financial arguments to convince the franchisees. Franchisees may also be rather passive in generating new ideas because they join the network mostly to benefit from the franchisor's insights. Consequently, in that type of franchise, a distinction between the ingroup (franchisees) and the outgroup (franchisor) is maintained as the franchisees fear losing their independence (Lawrence & Kaufmann, 2011). OI is fostered through rhetoric (Zachary et al., 2011), notably on innovation generation. Rhetoric mostly targets the outgroup (customers, external stakeholders). Furthermore, pressure to conform through social control from the outgroup is used to diffuse new ideas. The manipulation of OI and social control allow the generation of incremental creativity within the boundaries set by

the franchisor. However, it may lead to conflicts and a lack of alignment of the franchisors' and franchisees' interests when the distinction between the ingroup and the outgroup is prevalent. Finally, the franchise may be unable to change as its environment undergoes disruptive evolution.

Tab. 3: Comparisons of the creative process in the different categories of franchises

	Idea generation	Idea diffusion	Balance between conformity and variation
Network as a conduit for social control	Coming mostly from the franchisor	Enhanced by rhetoric on the brand's innovative capabilities	Strong conformity/incremental variations
Network as a place for intrapreneurs	Supporting idea generation from franchisees	Rhetoric on the idea generation process	Balance between conformity and variations
Network as a family	Through combination of previous experience	Through social control	Balance between conformity and variations
Network as a learning community	Through combination of previous experience	Enhanced by leveraging ingroup acceptance	Variations and low conformity
Network as a community of retailers	Through combination of local experience	Coercive pressure (contract)	Variations and failure to foster conformity
Network as a local community	Coming from the franchisor or new entrants	Coercive pressure (contract)	Local variations and low conformity

3.1.2 An intrapreneur network (high OI and a medium level of EI)

The head of the franchise focuses on fostering the perception that he or she belongs to the same group as the franchisees: a network of entrepreneurs. The following comments highlight the orientation towards entrepreneurship:

If we did not have our own outlet, we could not tell our franchisees that we are doing the same job. ... Currently, we are dealing with real entrepreneurs who are managing their company and are trying to achieve excellence. ... I think it is a good thing to have entrepreneurs at the head [of the network] who are fighting every day for their company's survival. (Case A)

Idea acceptance is facilitated by the fact that most ideas are presented as coming from the ingroup (the franchisor is here considered a member of the ingroup). There is no well-defined process to select ideas. However, the franchisor entices franchisees to experiment with new options and screens their results to identify strong growth franchisees. New ideas from franchisees emerge from direct contact with customers and everyday operational practices. The role of the franchisor is to identify innovative offerings or practices in the network. They described themselves as having a strong catalyst role as well as a leveraging effect for major innovations. Horizontal communication among franchisees to exchange new ideas is fostered, as highlighted in the following comments:

We entice exchanges among people, we organize meetings to discuss new ideas. ... There are local liaisons, and we try to have different profiles

of the same market [to have different perspectives and foster new recombination]. (Case B)

Franchisees are free to adopt a new idea, and the diffusion of new ideas is facilitated by finding advocates among franchisees. Consequently, ideas are perceived as coming from the ingroup. This process is described in the following comments:

I told the franchisee to go and see what is happening in [another] agency. I organized two immersion days in the agency of another franchisee. This conveys credibility to our discussions as it is a franchisee who talks to another franchisee to show that it is working. (Case B)

Arguments are based not only on financial data but also include information on the context of the source of the idea, as stated in the following comments:

You need to tell a story in the network. The story makes a substantial difference in convincing people about what they are doing. (Case A)

Consequently, in this configuration, both idea generation and acceptance are developed, and conformity is achieved by identifying and pointing to adequate prototypes inside the network. Creativity is enhanced through the combination of previous experience (Hargadon & Sutton, 1997). Forming teams of franchisees with a diversity of previous backgrounds enhances the generation of both incremental and disruptive new ideas, as proposed by Fleming, King, and Juda (2007). Rhetoric is used to speed idea diffusion. Contrary to the “hierarchical community” category, rhetoric is both generated by and targeted at other franchisees. Consequently, communication within the ingroup is fostered and used to enhance idea acceptance. The combination of a high level of OI and a medium level of EI allows both idea generation and diffusion to unfold smoothly in the network.

3.1.3 A family (high to medium level of OI and high level of EI)

This configuration is characterized by relatively young and/or small franchises. In these franchises, the founder opens a first business and then develops it as a franchise. The recruitment of franchisees is then based on the personal contacts of the founder (sometimes family members) or a good relationship with the franchisee. A strong community is established, and the term “marriage” is used to categorize the relationship with the franchisor, whereas franchisees are considered friends. Dense communications flow among the members of the community, which is animated by either the founder of the franchise or former franchisees. Franchisors believe that franchisees automatically communicate their good ideas and that their role as franchisor is to enhance exchanges. The generation of new ideas is based on individuation inside the network. Hence, differences in expertise within the network are valued, and groups are formed with actors with different profiles:

We recognize individual qualities. (Case E)

Several franchisors decrease the royalties that franchisees pay if they are involved in new idea generation and test them in their own business. That financial advantage, which

increases the differentiation in the network, is not perceived as a reward. Rather, it is viewed as a payment for the time spent and as a share for developing the idea, as highlighted by the following comments:

Instead of paying me franchising fees of up to 5%, this guy had to pay 1.5% because he was developing; he took care of all that (implementation of an innovation). So, yeah, he was given a reward, six months' worth, in fact; I exempted him from his fees for six months. (Case E)

Furthermore, stigmatization can be used to pressure franchisees to adopt an idea and thus to conform to the group's prototype, as described in the following comment:

You know, when there are only two [franchisees who did not adopt the idea] remaining, they became the ugly ducklings. (Case C)

This comment particularly illustrates the obligation to conform in the group, which is instilled through social relationships, as demonstrated by the use of the words “ugly ducklings”. In highly cohesive groups, alternative options are often disregarded and not accepted (Janis, 1982).

In this configuration, the balance between conformity and novelty in the network is achieved by enhancing direct contacts with the franchisor. The founder is often perceived as embodying the group's prototype and guiding creativity. However, as he or she often decides to grow the network, divisions emerge among newly arriving and former franchisees. We witnessed this situation in two franchise networks. One of the networks fostered its OI by promoting norms and operational excellence. Consequently, its prevailing identity shifted. That change created tensions with franchisees that had joined the network early because they felt that they had lost their independence and could no longer develop their own practices. In contrast, another high growth network did not change its processes. Older franchisees threatened to quit the network and reproached the franchisor for his or her creative contribution, whereas they perceived themselves as creative. These franchises are characterized by a division in identity, with the two groups described as the “younger” and “older franchisees”. In fact, this configuration embodies the risk of a strong identity. Because group cohesion is high, members are reluctant to admit any “outsiders” into their group (Castano, Yzerbyt, Bourguignon, & Seron, 2002). They are also more likely to reject ideas from the “outside environment” (Adarves-Yorno et al., 2006). Thus, strong EI and relatively high OI allow a high level of conformity as well as creativity as long as the composition of the network and the environment is stable. However, it can limit creative generation in uncertain situations concerning both the group and its environment.

3.1.4 A learning community (high EI and medium to low OI)

This group is characterized by sectors that require franchisees to have several years of experience in the field to be fully operational because either a degree is mandatory or the offering is complex. These networks have a low turnover rate. On-field consultants are part of the ingroup because they are former professionals from the same business and are perceived as prototypical, as highlighted in the following comments:

We set up a facilitation team with people who have worked previously in our business. They are often former franchisees or branch managers, so they know their job by heart. (Case H)

The network is perceived as a learning community, and the franchisor has little work to do to foster creativity, as described below:

The spirit of the group is very similar to one of a cooperative. We often consult the franchisees, and they give advice without us asking for it. We all know each other, and we communicate a lot. ... We do not need to emphasize the need to search for new ideas. (Case H)

On-line systems to collect ideas can boost idea generation based on extensive knowledge of practices in a field. For example, a franchise in the construction sector introduced an intranet on which franchisees can post improvement proposals. Other franchisees and members of the network can then vote on the proposed ideas. This system encourages franchisees to take a proactive role in idea selection and increases their involvement in the process and their identification with the franchise's concept. That franchise experienced an increase in the number of ideas proposed in its network. The diffusion of new ideas is facilitated through pioneers:

In the end, our pioneers are the best ambassadors, and they allow for adoption by the rest of the herd. (Case H)

The use of the pronoun “we” or “our” demonstrates that the franchisor considers himself or herself part of the group. Ideas are thus perceived as coming from the ingroup, which facilitates their acceptance (Adarves-Yorno et al., 2006). However, the pronoun “they” in the second part of the sentence shows that franchisees can freely exchange new proposals in the network. Creators are associated with pioneers, whereas adopters are characterized as “the rest of the herd”. This understanding relates to the fact that there are visionary leaders who guide members of the franchise; these members follow them blindly. This situation is characteristic of a cohesive group with a strong identity. In this type of group, a prototypical leader (here, the “pioneer”) symbolizes the identity of the group, and his proposals are systematically accepted in the group (Haslam & Turner, 2014). This facilitates idea adoption. However, the leader can deviate from the franchise's norm (Haslam & Turner, 2014) and propose ideas that do not fit with its concepts. These ideas will still diffuse quickly in the network.

Consequently, in these networks, a rich flow of new ideas is generated from the franchisees, and conformity is not strongly promoted within the network. In fact, franchisees have internalized the norms of their field and propose novelties that fit within them, which facilitates their acceptance both inside the franchise network and in the broader environment. This category of franchise is similar to a “freedom franchise” (Streed & Cliquet, 2017). In these networks, common values allow integrity to be maintained in the franchise, and innovations are encouraged.

However, because the field may undergo disruptive changes (for example, the use of self-employed workers in estate agencies or new requests from clients for a construction agency), dissension emerges between franchisees and franchisors regarding how to adapt

the franchise's core concept to major changes that depreciate the extensive knowledge that has been generated over the years. These dissensions may lead to the emergence of different identities in the network according to members' self-identification with different fields of expertise. It would then threaten the franchise's uniformity and brand integrity.

3.1.5 A network of retailers (medium EI and low OI)

Franchisors are considered to belong to the outgroup because they are product manufacturers and/or managers, whereas franchisees are described as retailers. The development of the identity as retailers is not shaped by the franchisor but comes from the history of the franchise.

The processes of idea generation are quite similar in this group as in the situation described previously, and franchisees are proactive in proposing new ideas. The following comment shows the correlation with the identification of franchisees as one group and the fact that they communicate new ideas:

We are in a franchise model with a strong culture of independent retailers. ... It is also part of our long- standing and strong culture of exchange. It is based on the fact that we are all doing the same job even though we are located in different places with different sized outlets, and so the interactions are very close. Consequently, as soon as one of us has a new idea, he/she is always happy to propose it and to instil it in others.
(Case J)

The creative process described in this comment arises from a local adaptation to demand (Cox & Mason, 2007). However, the acceptance of innovations is more complex. Because franchisees mostly perceive themselves as independent retailers, they reproach franchisors for not listening to their insights, and they oppose innovations from the franchisors because they feel that they do not correspond to clients' expectations, as described by the following comment:

Currently, we are reproaching [the members of the head of the franchise] because they do not feel the commercial sense of customers as the members of the head of the franchise are new and are coming with their own ideas. They have difficulties connecting with the people on the ground. (Case L)

The franchisees in one of the cases also refused to participate in an on-line system to post their ideas, and most new ideas were transferred to other franchisees without the franchisor's awareness. The on-field consultant is perceived as an outsider and cannot effectively liaise between franchisees and the franchisor.

The contestation of ideas can be explained by the fact that new ideas are perceived as coming from the outgroup. Consequently, franchisors impose their ideas by either removing the former system or references or by pressuring franchisees to order certain products, which leads to tensions within the network. Franchisors still try to facilitate the adoption of ideas by demonstrating their appropriateness to the group prototype. They

collect testimonies from other franchisees and include them in communication documents, as shown in this comment:

When we include verbatim comments, we can better communicate with other franchisees. (Case K)

Consequently, these networks are characterized by a relatively low level of identification (either organizational or expertise). As described in the literature, a low level of identification does not allow for the enhancement of creativity within boundaries (Ullrich et al., 2007). A medium level of EI allows the generation of new ideas. However, members of the group have difficulties assessing new ideas because they lack criteria forged by OI to assess those ideas. Furthermore, the low level of OI prevents franchisors from using any form of social control. Consequently, franchisors develop coercive pressure and, notably, reinforce the contract to maintain franchise uniformity. These actions tend to increase the distinction between the franchisor and the franchisees' identities and may damage the franchisor– franchisee relationship as well as the brand's integrity.

3.1.6 A local group (low OI and EI)

In the last configuration, subgroups with different identities emerge in the network. These identities form as franchisees perceive similarities arising from the fact that they operate in the same territory (geographical proximity) or they have undergone the same training process. In these networks, the franchise as a mode of development is either questioned or the core concept of the franchise is transforming. Consequently, neither OI nor EI emerges. New ideas mainly come from the head of the franchise or from new entrants to the network. This phenomenon can lead to communication problems in the network, which can prevent creativity as described in the following comment:

The first franchisees which joined the network are a driving force for new ones, but they are also the more demanding as they keep telling us that it was better before. ... We did not manage to set up relationships among generations, and [the different generations] have formed clusters inside the network. The youngest ones feel lonely, as they do not belong to the club of experts. (Case M)

In fact, it seems that only the older franchisees could propose new ideas and that those ideas cannot spread into the network, as there exist silos within the franchise system. In those networks, the franchise as a mode of development is either questioned or the core concept of the franchise is transformed, as shown in the following comment:

We became aware that the franchise model, as it was designed in 2006, is no longer a viable model in its current form. In the future, we aim to continue the expansion of our network but not necessarily in the form of a franchise. (Case M)

This last category shows that because OI and EI are low, the network is not able to generate and diffuse new ideas. Members of the network are not encouraged to share information and experiences because they perceive themselves as having little common ground. Franchisees are also not deeply involved in the broader network development

because they focus on the local context. This results in a lack of communication and intrinsic motivation, which impedes creativity (Amabile, 1988).

3.2 Cross-category analysis

The cross-category analysis demonstrates that EI and OI impact creativity differently. A high level of EI fosters idea generation within the group through a combination of experience, whereas OI enhances the transfer of new ideas from the outside environment to the group (Hargadon & Sutton, 1997).

In organizations with a high level of EI, ideas are perceived as coming from the ingroup and thus are easily accepted, which corresponds to the result of previous studies (Swann et al., 2003; Tang et al., 2014). However, we found that these ideas may not conform to the organization's interests. Furthermore, in categories with high EI, franchisors are assimilated into the ingroup, and newcomers may have difficulties being integrated into the network. This may lead to organizational rigidity and an inability to perceive changes in the environment.

In franchise networks, we identified three main vectors of EI: family, retailers and a specific expertise (learning community). A family EI means that franchisees consider themselves experts in developing networked organizations. They depend heavily on the founder of the network, which is a central component and is characterized as a leader, as defined by Haslam and Platow (2001). Because social identity is strong in the group, the founder embodies prototypical behaviours and can impose his or her vision of creativity on the group. Consequently, franchisees are highly dependent upon the franchisor and may lose their autonomy. In contrast, franchises that have an EI related to a specific job expertise emphasize franchisees' autonomy and task-related knowledge, which are conducive to individual creativity (Amabile, 1988). Entities are then considered independent and can adapt their know-how to the local context of their business. An EI related to the "retailer" job is characterized by different meanings associated with the task-related content. Consequently, franchisees do not share enough common values and norms to generate a flow of new ideas. Furthermore, they perceive their job mainly as trading existing products. Consequently, innovating and adapting the offerings are not their main focus.

In networks with a high level of OI, uniformity and social control are enhanced. The main risk lies in the perceived distance between the franchisor and the franchisees. Thus, we can differentiate between two different types of OI. The first type of OI focuses on the franchise's branding and reputation. In these instances, the franchisor is perceived as belonging to the outgroup and as the main source of new ideas. Contrary to the work of Hirst et al. (2009), franchisees are not deeply involved in creative tasks because the culture of these franchises mostly emphasizes uniformity. In contrast, OI may be oriented towards intrapreneurship. In these instances, both creativity and conformity are fostered, as described by Dada and Watson (2013).

Conclusion

Recent studies have described creativity as a paradox that requires new practices and actions as well as stability, norms and routines (Fortwengel et al., 2017; Goncalo, Chatman, Duguid, & Kennedy, 2015). We shed new light on one paradox that involves balancing novelty and conformity. We demonstrate that networks of individuals can promote both idea generation and a uniform diffusion of those ideas by enhancing OI with a strong entrepreneurship orientation or EI based on occupation-specific knowledge acquired through experience. Thus, we extend Tang et al.'s (2014) work by applying the concept of expertise and OI to another context and demonstrating that the content of identity matters. Strong OI that is based on reinforcing the brand and its know-how constrains the generation of innovations with a high level of uncertainty. Conversely, EI based on group comparisons with retailers inhibits the transfer of new ideas from franchisees to franchisors. Our results also provide a better understanding of how Adarves-Yorno et al.'s work (2006, 2007) can have implications for organizational environments. First, it shows that managers can manipulate group identity to facilitate an idea's acceptance. Managers can promote prototypical individuals (individuals who embody the norms of the group) to participate in committees to develop new ideas. Consequently, new idea development will be considered a valuable activity in the group. Managers can also present a new idea as coming from the ingroup by using narrations that depict ingroup members as users of the idea.

One of the main contributions of this article is that it describes a particular context in which ideas are selected by multiple audiences (Ford, 1996). Organizations increasingly rely on the formation of networks to develop innovative projects. These networks often involve individuals working for different companies. Thus, a challenge is to entice these groups of individuals to develop new processes and products that conform to the norms of different audiences. Our results suggest that in such a context, social control, which may be exerted by manipulating the group identity, is an efficient lever to increase both the diffusion of the idea and its variation from existing standards. We also provide new insights for idea generation in franchising.

The literature on franchising has mainly explained franchisees' propensity to propose new ideas through analyses of the quality of franchisor–franchisee relationships (Clarkin & Rosa, 2005; Combs, Michael, & Castrogiovanni, 2004; Davies, Lassar, Manolis, Prince, & Winsor, 2011; Watson et al., 2016). Our research proposes a complementary perspective by showing that the manipulation of the organizational social identity by managers enables the emergence of new ideas that conform to the franchise's concept. Thus, the uniformity of the franchise system can be reinforced through the creation of a strong and unique OI oriented towards entrepreneurship. Franchisees who do not conform to the norm of the group are then stigmatized and face pressure from the group to adapt their behaviours.

Our research shows that certain types of group identification promote the internalization and integration of norms supporting change and new idea adoption and thus may lead to self-determined behaviour to adopt new ideas. Consequently, franchisors must reinforce the process of internalizing the value of changes and innovations. Such internalization is promoted when individuals feel as though they and the management team belong to the same group and value the people in that group (Ryan & Deci, 2000).

Regarding future research avenues, we suggest that investigations study other domains that require the involvement of actors embedded in a community to test the effect of different types of group identification on the ideation process. The relationships between the franchisees' level of involvement and the salience of the group identity can also be examined to understand franchisees' behaviour.

Our study also has implications for practice. We demonstrated that identification plays a major role in the creative process, and managers can promote EI and OI by highlighting the differences between the franchise and other organizations operating in the same sector while at the same time encouraging collaborators to participate in community practices. Franchisors or managers of network organizations can also try to position their company on the map that we have proposed. They could then identify whether the major challenge to their organization lies in generating new ideas or having their ideas accepted within the network. Managers could then act to either present the idea as coming from the ingroup or develop systems to foster information flows within the network.

Some limitations potentially constrain the generalizability of the findings. First, although we chose to maximize the variations of the context to take into account different situations in terms of franchise systems' age, sector and structure, the small sample size represents a potential limitation of the study. Second, our analysis relies on data from a single country, France. This raises concerns about the generalizability of our results to other countries, particularly those with a different entrepreneurial culture. Recent results suggest that national culture plays a major role in the entrepreneurial orientation rhetoric contained within franchisee recruitment promotional materials (Watson, Dada, Wright, & Perrigot, 2017). It would therefore be interesting to extend our research to contrasting cultures to determine whether the role played by identification in franchise systems' creative processes is universal. Third, we acknowledge that OI and EI may overlap and that there may be different degrees of identification. These limitations constitute a new challenge for future research.

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Challenge of Sustainable Reporting: Case Study of Major Companies in the Czech Republic

Abstract

The paper deals with changing corporate reporting with regards to the sustainability. Sustainability reporting is a recent phenomenon in the field of reporting, offering a number of challenge, such as increased transparency and credibility in the eyes of stakeholders, impact on business performance, etc. On the other hand, it also brings a number of problematic areas, which it would be worthwhile to clarify in the future, so that the benefits of these activities can be fully exploited. The paper discusses the approach of the most important companies in the Czech Republic included in the CZECH TOP 100 ranking to sustainability reporting. Companies are far from using full sustainability reporting, as shown the quantitative analysis of 2016 data. Although the analysis was carried out on a sample of the major companies in the Czech Republic, only 64% of these companies reported on sustainable activities, most often in their annual report. The relationship between the sustainability reporting rate and the size of the business turnover was proved. The importance of the turnover indicator is also evident from the conclusions of the cluster analysis. Very significant difference in approach and level of sustainable reporting between the highest turnover companies and the rest of the most important Czech companies was detected. The analysis also showed that the content, structure and scope of sustainability reports are very individual.

Key Words

Reporting, sustainability, Czech companies, cluster analysis

JEL Classification: M10, M14

Introduction

Sustainable performance is currently a frequently inflected theme. The importance of social and environmental aspects has risen considerably over the last few years, increasing the pressure on organizations to manage not only their economic but also environmental and social performance, and to inform all stakeholders of the impact of their activities on the environment. Recently, several examples have shown that non-financial information has a significant impact on business performance, so investors and other stakeholders should not focus solely on the business financial indicators (Georgeevski and AlQuadah, 2016).

A study conducted by Ernst & Young (2018) on the importance of non-financial information to the investment decision-making process shows that 97 % of investors are evaluating disclosures of non-financial character when assessing the company. Only 3 %

of respondents did little or no review of non-financial performance in 2018, in comparison to 22 % in 2017 and 48 % in 2015. According to this study, the third most commonly preferred source of non-financial information is CSR or sustainability report. The most preferred source is integrated report, followed by annual report. The strongest incentives for the disclosure of non-financial aspects of business are: compliance with regulatory requirements (90 %), risk management demonstrations (87 %), long-term value strategy explanation (78 %) and competitive pressure respond (70 %). Less motivation has incentives such as investors demand for non-financial information (44 %) and improvement of reputation (40 %).

Horváth and Pütter (2017) consider a sustainability report as a non-financial report that provides stakeholders with information about engaging a selected organization in corporate sustainability issues. The term corporate sustainability generally refers to the integration of concept called „*the triple bottom line*“ to corporate activities. The triple bottom line consist of three main pillars – economic, social and environmental, which should be extended by corporate governance. Corporate Governance, on the one hand, is a system of how a business is managed and, on the other hand, a system of managerial responsibility for corporate governance and performance. Regarding to the triple bottom line concept the condition of sustainable business performance is met when all the pillars are in equilibrium. At an equilibrium point located at the intersection of all aspects of sustainability, there is an enterprise that achieves excellent economic results and has achieved stable economic growth, all in combination with environmentally friendly resource management and environmental concerns, while respecting everyone's needs (Elkington, 1998).

The main purpose of a sustainable report is to provide information to both internal and external stakeholders, while internal users use it not only to assess past corporate development and the current state of business activities, but also as a basis for decision-making on future activities with an emphasis on improvement of business performance. According to Paun (2018) the benefits of sustainable reporting lie in increased transparency, credibility and accountability, more ethical behavior of the company, customer loyalty, reduced legal as well as insurance risks and costs, access to attractive capital, reduced forecast inaccuracies etc.

In the field of non-financial reporting, there have been rapid changes over the last few decades. While studies from the 1990s consider the concept of environmental reports (Azzone et al., 1997; Deegan and Gordon, 1996; Epstein, 1996; Fried, 1993), studies from the first decade of the 21st century mention sustainability reports (Hassan and Ibrahim, 2012; Kolk, 2003; Russel, 2007) and the most recent ones are focused on the integrated reporting (Dragu and Tiron-Tudor, 2014; Du Toit, 2017; Eccles and Saltzman, 2011; Havlová, 2015).

There are several basic approaches to sustainable performance reporting such as the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), United Nations Global Compact (UNGC) and the most recent one is International Integrated Reporting Council (IIRC). Bellucci and Manetti (2018) report that the most widely used evidence for a voluntary sustainable report are the Global Reporting Initiative manuals.

The concept of sustainability reporting still faces problems concerning in particular the inconsistency in the interpretation of basic concepts, the uncertainties between the relationships within the pillars and, last but not least, the non-standardized methodology for reporting sustainable performance and different approach of enterprises.

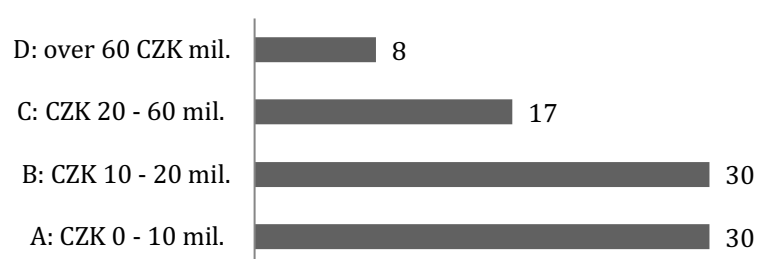
The aim of the paper is to discuss the approach of 100 major companies in the Czech Republic to sustainability reporting. Following **research questions** were formulated in order to examine companies' approach:

1. *What is the level of companies' reporting on sustainable activities?*
2. *Does sustainability reporting depend on the turnover size of companies?*

1. Methods of Research

The **research sample** was presented by the 100 most important companies in the Czech Republic, ranked in the CZECH TOP 100 ranking published in 2015 (see www.czechtop100.cz for more details). This sample was refined in successive steps by companies that did not have complete data and duplicates in the sample. The resulting sample was represented by a total of 85 significant companies operating in the Czech Republic. Fig. 1 shows the absolute frequency of companies by annual turnover (divided into categories A to D).

Fig. 1: Sample of Analyzed Enterprises by Turnover Size (Absolute Frequency)



Source: authors' own calculations

Data on business access to sustainability was collected and progressively recorded in a file based on a detailed analysis of companies' published disclosures in 2016. For information sources were chosen:

1. companies' annual reports,
2. any report declaring the enterprise's approach to sustainable development in various forms (sustainable development reports, corporate social responsibility reports, environmental reports, etc.),
3. companies' websites.

These resources are a manifestation and evidence of the integration of sustainable aspects into business processes, reflecting the characteristics of a sustainable strategy and reported facts. Information and data were obtained from the content analysis of the

above-mentioned information sources. The absolute and relative frequency of sustainable business activities reporting in the form of a selected report by business category, depending on the amount of sales achieved, were recorded and analyzed. In addition, indicators on the scope and content of reports were monitored.

It was used the chi-square independence test to determine the dependence of reporting on sustainable activities on companies' turnover size. The following hypotheses were verified:

H0: Sustainability reporting of companies is independent on the turnover size.

H1: Sustainability reporting of companies depends on the size of the turnover.

When the relationship between the two variables has been proved, the Cramer coefficient (V) was used to measure the intensity of this relationship (Řezanková, 2011):

$$V = \sqrt{\frac{\chi^2}{n(\min(c; r) - 1)}} \quad (1)$$

Where χ^2 is test statistic of chi-square test, n is total sample size, c is the number of columns, r is the number of rows in contingency table.

Furthermore, cluster analysis was used to identify differences in reporting, to define a group of companies with the highest reporting rate. The aim of the cluster analysis is to divide objects (in this case companies) into clusters so that the objects assigned to one cluster are close (similar) to each other, and objects assigned to different clusters are distant, i.e., dissimilar, from each other. Using a cluster analysis, we can identify a group of companies that stand out in terms of the observed variables; companies displaying low values in all the variables; and companies that excel only in some of the observed areas. (Hebák et al., 2007)

The distance matrix (of objects or clusters) clearly indicates the similarity or dissimilarity of individual objects or clusters. The Euclidean distance expresses the measure of similarity (distance) between objects. High values of distance indicate dissimilarity between objects. We have a group of n objects, each of which is characterized by p attributes (variables). The Euclidean distance d_{ij} between objects i and j can be determined as follows (Stankovičová, Vojtková 2007):

$$d_{ij} = \sqrt{\sum_{k=1}^p (x_{ik} - x_{jk})^2} \quad (2)$$

where x_{ik} is the value of variable k for object i and x_{jk} is the value of variable k for object j .

2. Results of the Research

Of the total number of companies surveyed, 64% of companies report their activities in relation to sustainable development. Differences are evident in the categorization of companies by turnover. The highest proportion of companies that do not report on

sustainable activities is from category A, ie. companies that have the lowest turnover in the sample (60% of Category A companies do not report sustainability in the form of a report).

The most common way in which companies report details of selected sustainable activities is in the annual report (89% of companies). There are considerably fewer businesses devoted to non-financial reporting in the form of sustainable development or CSR reporting. Sustainability report handles 15% of companies reporting, CSR reports then 24% of companies reporting. Some companies report non-financial information both in the annual report and in a separate report on sustainability or CSR where these activities are more elaborated.

The analysis of companies' reports also showed that the content, structure and scope of sustainability reports are very individual. Differences can be influenced by branch of business, size of enterprise but also by the fact how important enterprises consider the concept of sustainable development.

When testing independency of sustainability reporting on companies' turnover size test statistics $\chi^2 = 15.3858$; p-value = 0.0015. The low p-value indicates strong evidence against the H0. The null hypothesis H0 is rejected, it is confirmed the dependence of sustainability reporting on turnover. The Cramer coefficient $V=0.4254$, which indicates significant dependency. The level of sustainability reporting is dependent on the size of turnover, this dependence is strong.

The importance of the turnover indicator is also evident from the conclusions of the **cluster analysis**. Obviously, cluster number 1 contains companies with the highest number of reported indicators – see table 1. This cluster is most different from other ones – see the table 2. Companies in other clusters do not show such high reporting rate. In cluster 1, seven companies with large turnover were included – three of them were the largest ones, other companies were from the first quartile.

Tab. 1: Average number of reported indicators

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Economic indicators	2.0	1.0	2.1	1.1
Environmental indicators	5.9	0.1	0.3	0.0
Social indicators	2.9	1.0	1.3	0.0

Source: authors' own calculations

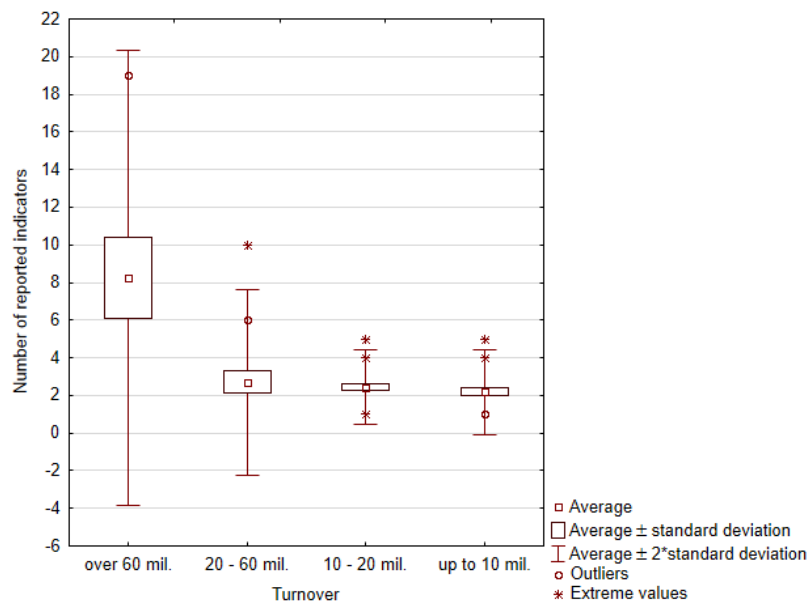
Tab. 2: Euclidean distance among clusters

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Cluster 1	0			
Cluster 2	3.518239	0		
Cluster 3	3.329588	0.66122	0	
Cluster 4	3.798595	0.599919	0.951392	0

Source: authors' own calculations

The relationship between the sustainability reporting rate and the size of the business turnover is illustrated by the box plot (Fig. 2). This chart also shows that companies with high turnover report the most indicators.

Fig. 2: Box Plot – the Relationship between the Number of Reporting Indicators and the Turnover



Source: authors' own calculations

In the economic area, companies usually report economic performance indicators, in particular financial statement indicators, turnover or profitability indicators, the size of sales and the size of markets served. Environmental indicators include indicators of greenhouse gas emissions and other air emissions, waste, costs and investments for environmental protection and energy consumption. Of course, reporting is influenced by the subject of the activity being performed. In the social area, most companies report information on the number and structure of employees, rates of sickness and accident rates, hours of employee training.

3. Discussion

The level of sustainability reporting of Czech companies sample detected by quantitative analysis can be compared with the results of some international studies from a similar period. The KPMG study (KPMG, 2015) conducted in 45 countries around the world also shows a relatively low reporting rate of CSR activities in the Czech Republic compared to other countries. In this study, 250 of the world's largest companies and then the 100 largest companies in each country were evaluated. In Europe, companies in France (93% of the 100 largest companies), the UK (90%), Norway (86%) and Denmark (82%) report the most on sustainable activities. In the Czech Republic, only 43% of the 100 largest companies report about sustainability activities according to the KPMG study (2015). In comparison with the results of our research (where 64% of companies dedicated to sustainability reporting), the rate of reporting of activities related to sustainability gradually increases.

On the other hand, these activities can be expected to grow at significant companies, both in connection with the implementation of the EU Directive on non-financial reporting, according to which selected business entities in the Czech Republic have a legal obligation to report their non-financial indicators since 2017 and also in connection with the global development of this concept and the challenges that sustainable reporting brings.

Dependency of the level of sustainable reporting on the size of the company's turnover was expected. A surprising finding is the very significant difference in approach and level of sustainable reporting between the highest turnover companies (category D) and the rest of the most important Czech companies. The methodology for the procession of sustainability reports proves to be a problematic area. Reports have no uniform template and it is very difficult to compare within companies, or to assess the development of sustainable activities for individual businesses unless they maintain the same reporting structure, including basic reported indicators.

Conclusion

Although the analysis was carried out on a sample of the major companies in the Czech Republic and most of these companies boast of integrating sustainability into their corporate strategy, only 64% of these companies reported on sustainable activities, most often in their annual report. The chi-square independence test confirmed the dependence of sustainability reports on the size of business turnover. Separate CSR reports or sustainability reports are handled by a relatively small number of companies, most often by the highest turnover (category D), such as Škoda Auto, a.s., ČEZ, a.s., or Agrofert, a.s.

Reported indicators of sustainable performance follow the lower frequency of sustainability reporting. Czech companies most frequently reported economic indicators in the published reports. It can be seen that the measurement and reporting of sustainable performance is not a common practice of Czech companies (with a few exceptions), setting indicators of sustainable performance is not easy and it will require some time. Development of approach of the most significant companies in the Czech Republic to sustainability reporting in the form of comparing the analyzed data with those in the coming years is the subject of future research.

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Sustainability and Corporate Social Responsibility in Business

Abstract

The paper focuses on corporate social responsibility and sustainability in business. The aim of the paper is to discuss how corporate social responsibility and sustainability is spread into actual business sphere and what kind of aspects are considered based on analysis of selected businesses sample. The first, theoretical part of the paper is aimed to make an introduction of corporate social responsibility and sustainability, such as definition and development of these approaches. The empirical part, discusses if and how businesses, based on selected sample of businesses, implement various aspects of corporate social responsibility and sustainability into their business strategy. Last trend, sustainable developments goals and their possible implementation into corporate social responsible and sustainable approach of businesses, is discussed too. The sample of businesses is concentrated on the area of the Czech Republic and represents significant group of organizations accepting corporate social responsibility and sustainability as an important part of their business activities. The results of the analysis indicate what kind of aspects influence sustainable and corporate social responsible business strategy, also with respect to the theoretical background of these concepts, and what kind of degree already have reached the sample of businesses. Recommendations for future development and future trends for this area of research are indicted in conclusion.

Key Words

sustainability, corporate social responsibility, SDGs, business

JEL Classification: M14, Q56,

Introduction

In recent years, attention has been increased for the peculiarities of sustainability and corporate social responsibility (CSR). Many attempts have been made to define the concept of CSR and sustainability, to develop discussion on their importance and hence to widespread this approach into broader business practice. The concept of CSR, more precisely of sustainable development (sustainability), is certainly not new, but there are many definitions in various dimensions.

First, let's start with sustainable development (sustainability). Sustainable development, or sustainability, are generally accepted terms and are commonly understood as synonyms. The term sustainability has been used within the wide society later, when speaking about the concept of sustainable development and its concrete principles. Sustainable development represents a complex area and addresses a large number of topics. These topics have been very much discussed since the second half of 20th century,

however, it has its origins in Europe in the early 18th century in context of forestry and agriculture (Wiersum, 1995). Definition of sustainability (sustainable development) varies. World Commission on Environment and Development (1987, pp 16) defines it as „*development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*” Or, the Office of the Government of the Czech Republic (2017) understands this concept as complex and dynamical system, where all parts of interest (economic, environmental and social) are interconnected and their balance must be respected. The majority of scholars, e.g. Kunz (2012), Van Marrewijk (2003), associate this topic with 3 main pillars: (a) economic, (b) social and (c) environmental. Sustainability is built on complexity of these 3 pillars, when no one of these pillars is understood as dominant.

To sum up, sustainability is frequently explained in 3 possible ways (Ministry of Regional Development, 2012): (a) based on World Commission on Environment and Development (1987, pp 16), (b) based on 3 pillars and (c) based on capital assets (human, social, natural, productive and financial). More details on the development of sustainability concept is shown in Tab. 1.

Tab. 1: Main pillars in sustainability development

Year	Document	Description
1992	"Declaration on Environment and Development"	It contains 27 principles of sustainable development and the "Agenda21", a detailed environmental action plan. The aim is to reconcile economic and social development with effective environmental protection.
2000	"Millenium development goals (MDGs)"	Preserving a sustainable future has been described as the most urgent challenge of today.
2002	"World Summit on Sustainable Development"	It stressed the essence of sustainable development in ensuring the balance of the three fundamental pillars: social, economic and environmental.
2012	"The Future We Want"	UN Member States adopted this document. And they decided to launch a process to develop a set of SDGs to build upon the MDGs and to establish the UN High-level Political Forum on Sustainable Development.
2015 - 2030	"Transforming our World: The 2030 Agenda for Sustainable Development"	All UN Member States, representatives of civil society, the business community, academia and citizens from all continents participated in the formulation of Sustainable Development Goals (SDGs).

Source: authors'own based on WHO (2002), UN (1992, 2012, 2019)

Last movement in sustainability concept is Agenda 2030 that provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. There are 17 SDGs that represent overall program for all countries implementing economic, social and environmental aspects of sustainability. These SDGs are shown in Fig. 1 and are considered as a key, common future direction of sustainability.

Fig. 1: SDGs



Source: UN (2018, pp 11)

In contrast to sustainability, CSR historical roots come from the United States as an act against incorrect and anti-social behavior of some large companies. As well as sustainability, CSR has also numerous definitions. One of the pioneer CSR scholar, Archie Carroll (1979, pp 499) defines CSR as „*the economic, legal, ethical and discretionary expectations that society has of organizations.*“ Bowen (1953) describes CSR as a concept by which companies integrate, on a voluntary basis, social and environmental aspects into mainstream of business operations and interaction with stakeholders. CSR is commonly connected to economic, social and environmental pillars (as well as sustainability) and is usually defined as company responsibility for their society influence. Currently, it is impossible to find out universal approach to CSR. Carroll and Buchholtz (2015) give the credit to this fact due to the multidisciplinary of this concept. In fact, definitions of CSR are very similar. Dahlsrud (2008) comments that in majority of examples following terms appeared regularly: environmental, social, economic, stakeholders and voluntariness.

There are several discussions (e.g. Van Marrewijk, 2003, or Wright and Bennett, 2011) how the concept of CSR and sustainability come together. It is significant that both concepts are very close, frequently taken for synonym. However, there are differences. Both concepts have a different origin and can be provided by several activities. Both are based on triple bottom line concept (economic, social and environmental pillars). To sum up, sustainability and CSR concepts are very close. CSR could be considered as an effective approach how to reach sustainability in business activities, and is understood as a part of broader concept – sustainability. CSR is a practical tool that is unique to every business and responds company’s current challenges. CSR activities may differ for each company, sector, environment and depends on several factors, such as national legislative requirements, ethics or moral rules across society. It is hardly achievable to specify CSR and sustainability into one, universally applicable multidimensional concept. CSR and sustainability is dedicated on several factors. Presumably, as a result of this fact, in practice many approaches have focused on chosen dimension of CSR and sustainability. Globally, there is increasing number of global reports on CSR and sustainability, e.g. UN Global Compact & Accenture (2016), or McKinsey study (2011), that show increasing attention and more detailed description about companies activities. Unfortunately, in domestic, Czech, conditions there is hardly possible to find overall studies presenting companies approach to CSR and sustainability. The spectrum of possible CSR and sustainable activities, as well as the companies approach itself to this topic, is naturally influenced by several aspects. The most important are mentioned in Tab. 2.

Tab. 2: Aspects influencing CSR and sustainable approach

Aspect	Description
Size of company	Usually connected with visibility and volume of activities.
Territorial specification	Territorial specification plays important role, not only in distinguishing on domestic and international businesses, but also in facts such as local culture, legislation, society requirements etc.
Sector of activity	Higher level of commitment can be expected in sectors with higher probability of company legitimacy threat among society.
Ownership and management	Distinguishing ownership and company management can influence the content and volume of information release.
CSR/sustainability standards	Organizations can follow and report CSR and sustainability also based on several standards/norms, that can help them to manage these activities.

Source: authors' own based on Kašparová, Kunz (2013), Leipziger (2010)

1. Methods of Research

The aim of this paper is to shed a light on businesses' CSR and sustainable approach. Data collection is therefore crucial. The paper meets this need by providing desk research based on literature review, analysis of secondary data (company website, annual reports and other databases) and by applying method of order and Saaty approach (2000). The empirical research enables to see the level of activity on several CSR, sustainable aspects, thus to explore the degree to which engage businesses subjects this concept into their business strategies.

Several dimensions of CSR and sustainability has been included into this research - social, environmental and economic issues that are typically linked to CSR (e.g. UN Global Compact & Accenture, 2016; McKinsey, 2011):

1. Environmental pillar: renewable energy, recycling, reduction of emission and waste, reduction of noise, water consumption, reduction of energy and material consumption.
2. Social pillar: healthy and safety work conditions, supply chain management, gender diversity, children work, impact on the local community and community relations management, company philanthropy, education and professional training, worklifebalance.
3. Economic pillar: economic performance, investment policy, system of management, financial development and payment ability.

Furthermore, aspects influencing CSR and sustainable approach (Tab. 2) have been observed. And, last but not least, work with SDGs was observed too.

The research was held among members from business sphere of the Association of Social Responsibility (A-CSR). The A-CSR is the largest organization providing support in CSR and sustainability in the Czech Republic. The choice for the selected sample of businesses was motivated by one crucial consideration. A key motivation was the desire to build on a relevant body of organizations considering CSR and sustainability as in important part

of their strategy and activities (thus their membership in the A-CSR). The sample consists of 117 business members of the A-CSR (see Tab. 3).

2. Results of the Research

Tab. 3 reports results for structure of the sample, when criteria from Tab. 2 were followed. It reveals that the majority of companies are limited liability company, followed with joint stock companies. Also, the majority operates only in the Czech Republic (87 from 117). Unfortunately, companies activities are spread across large spectrum of sectors, thus this can be considered as a limitation of this research since it is not possible to discuss the sector influence on CSR, sustainable activities. Furthermore, more than 52% of businesses distinguish strictly ownership and company management (mainly big companies). When following this aspect, information distribution about CSR and sustainable activities confirm very clearly the fact that these companies tend to provide more detailed information regarding their activities in comparison to those, that do not distinguish ownership and company management issues. Only 12 subjects (10% of sample) support and follow their activities by implementing various standards (GRI, ISO 14001, 50001, 9001, 180001 etc.).

According to the database outputs, it was found that 100 subjects provide information regarding their CSR and sustainable activities (either on websites or in annual reports). The remaining 17 companies do not present their activities through their companies channels (websites/annual reports/or other channels). Information about their activities was found only on the A-CSR website. This fact is quite surprising. Also, only 15 (of the 100 subjects providing CSR information) generate CSR (sustainability) reports and just 10 of those 15 implement their reports in order to SDGs goals. All the reporting companies (15 subjects) strictly distinguish management and ownership issues.

Tab. 4 introduces the structure of sample according to sustainable pillars. Most companies focus on the economic and social pillar, two thirds of the sample companies devote to the environmental pillar. The dominance of social pillar in comparison to environmental is obvious.

Individual aspects of each pillar are listed in Tab. 5. In the environmental section companies focus mainly on providing information regarding reduction of emission and waste, energy and material consumption. The spectrum of activities in social pillar is wide, however the highest impact is placed (no matter what size of the company is it) on interaction with local community, employees worklifebalance and education and professional training. Some parts of social pillar are mainly task of big companies, especially supply chain management (also in the meaning of fairtrade principle). As a positive fact can be considered company philanthropy, that is represented quite equally across all businesses' size. On the other hand, gender diversity is surprisingly in focus of very few companies, even if it is generally understood as one of the important part of social pillar. In terms of economic pillar, data regarding economic performance and financial development are considered as standard measures, but information regarding system of management a investment policy are provided only aprox. by 50% (30%) of the sample.

Tab. 3: The structure of sample according to legal form, teritorium and sector

Legal form/Size	Micro	Small	Medium	Big	Total
Ldt Liability company	43	23	9	17	92
Joint Stock Company	1	2	6	11	20
Self-employment	2				2
Other		1	1	1	3
Teritorium/Size	Micro	Small	Medium	Big	Total
Czech Republic	44	18	9	9	80
Worldwide	2	8	7	20	37
Sector/Size	Micro	Small	Medium	Big	Total
Automotive				1	1
Constructions and materials			1	1	2
Financial services	1	1	2	6	10
Food and beverage	2	3	1	6	12
Forestry and paper	1				1
Healthcare	1				1
Chemicals			2		2
Industrials, manufacturing and metals			1		1
Other	28	15	2	3	48
Personal and household goods	3	4	3	6	16
Retail	3		1	2	6
Technology, Media a Telecom	7	2	1	2	12
Transport and leisure		1			1
Utilities			2	2	4
Ownership and management/Size	Micro	Small	Medium	Big	Total
Yes	7	15	11	29	62
No	39	11	5		55
Total	46	26	16	29	117
Reporting - standards/norms	Micro	Small	Medium	Big	Total
Yes		2	6	4	12

Source: authors' own (2019)

Tab. 4: The structure of sample according to pillars

Pillar/Size	Micro	Small	Medium	Big	Total	All Businesses
Environmental	21	16	12	23	72	×
Social	46	25	16	29	116	×
Economic	46	26	16	29	117	✓
Total	46	26	16	29	117	

Source: authors' own (2019)

To support this data, weight (the importance) for each individual aspect in each pillar was calculated individually for each pillar based on order method and also based on Saaty approach (2000). The most valuable aspects are grey coloured in the Tab. 5. In case of both calculation (order method and Saaty approach) the same aspects seems to be preferred by the sample of businesses with slightly differences in less preferred aspects.

Tab. 5: Aspects of environmental, social and economic pillar

Aspects of environmental pillar/Size	Micro	Small	Medium	Big	Total	Weight (Order)	Weight (Saaty)
Renewable energy	1	5	3	17	26	0.10	0.10
Recycling	9	11	9	19	48	0.19	0.22
Reduction of emission and waste	17	14	9	20	60	0.29	0.26
Reduction of noise	X	X	X	3	3	0.05	0.04
Reduction of water consumption	8	7	4	13	32	0.14	0.12
Reduction of energy and material consumption	16	15	7	20	58	0.24	0.26
Aspects of social pillar/Size	Micro	Small	Medium	Big	Total	Weight (Order)	Weight (Saaty)
Health and safety work conditions	16	11	11	22	60	0.11	0.09
Supply chain management	3	1	1	13	18	0.08	0.03
Gender diversity	X	X	2	6	8	0.06	0.02
Children work	X	X	1	2	3	0.03	0.02
Impact on the local community and community relations management	46	25	16	29	116	0.22	0.31
Company philanthropy	20	14	11	24	69	0.14	0.1
Education and professional training	29	15	9	24	77	0.17	0.12
Worklifebalance	44	24	16	28	112	0.19	0.31
Economic pillar/Size	Micro	Small	Medium	Big	Total	Weight (Order)	Weight (Saaty)
Economic performance	46	26	16	29	117	0.40	0.42
Financial development and payment ability	45	26	15	28	114	0.30	0.42
System of management	8	14	11	28	61	0.20	0.1
Investment policy	3	6	5	24	38	0.10	0.05
Total	46	26	16	29	117	X	X

Source: authors' own (2019)

Our research indicates also that international companies engage in different types of activities in comparison to domestic. International subjects pay higher attention (at least 30% and more difference) in comparison to domestic subjects to following aspects: (a) renewable energy, (b) water consumption, (c) supply chain management, (d) system of management and (e) investment policy.

3. Discussion

The research documents various aspects of CSR and sustainable activities by companies that accept the CSR as important part of their strategy (hence their membership in the A-CSR). There is a limited number of studies (e.g. McKinsey, 2011; UN Global Compact & Accenture, 2016) that are reporting types of activities on CSR or sustainability. To this extent research on actual CSR and sustainability level is scarce.

Although presented research is clearly not intended to represent an exhaustive list of CSR and sustainability degree of activities, it represents a range of activities that are applied by various businesses subjects. Hence it creates a sample framework of businesses

approach to discussed topic. This study shows that researched companies do engage in several types of CSR or sustainability. However, only a few of them follow the last trend in sustainability – SDGs. The level of engagement in SDGs is so far very low. Only 9% of the sample actively work with SDGs concept and provide activities in connection to SDGs. All of these subjects provide also an CSR/sustainability report. The majority of this 9% are big sized companies and globally managed. Thus, deeper link to SDGs should be definitely a priority for future CSR/sustainability development, since the actual businesses approach is on a low level.

There is also visible a little effort to manage supply chain management (especially among big companies) in the way of monitoring of fair supply ways. A very limited attention is also placed to gender diversity and children work. Gender diversity is mainly the topic among big, or medium sized companies. At the same time, there is a deficiency in availability of concrete data related to sustainable activities (environmental and social). Few data (in terms of real figures) is possible to find, basically related to reduction of emission or related to social activities (company philanthropy), or only numbers of supported programmes or people are provided. In contrary to this, other sustainable aspects are described only verbally. This fact could be considered as a limitation in visibility of sustainable activities and their volume against stakeholders. At the same time there is a visible lack in reporting. Only few subjects provide reports on their activities, even if this kind of report, again, could help to clarify a provide clear information toward sustainable activities. Thus, recommendation to concentrate on reporting, exact data visibility is obvious.

Major and positive trend is understood in increasing companies tendency towards the term sustainability. One third of companies rank their activities as CSR activities, while two thirds of companies consider them as sustainability activities. This is a major progress that can be expected to grow on.

As limitations of this research may be considered the sample size and it's distribution across sector of activity. Unfortunately, due to various spectrum of subjects activities, insight on activities in relation to observed aspects is limited. However, according to criteria of sample choice, these subjects may be consider as subjects with very high activity in sustainability and CSR.

Conclusion

The research results show clearly that idea of the sustainability and CSR concept is not by definition directly applicable to every business subject and is calling for separate investigation. Each business organization deals with CSR and sustainability concept in a fundamentally different manner, e.g. international businesses in comparison to local businesses have for example clear connection to stakeholder expectations, global organization strategy and hence they provide higher volume and different form of information. The research objective of this paper is in increasing knowledge about the constitute of CSR and sustainability in business strategies in companies that accept the idea of CSR and sustainability as an important part of their activities. One could argue that even different CSR or sustainability approach may be applied, it necessarily does not mean that similar outcomes and practices will be practiced and reached. Findings of this paper indicate aspects in each pillar, that are mostly provided by the sample of businesses

and provide more details to this information, also in relation to companies structure. Only a few other aspects appear next to these main ones (in social pillar), however they are still very strongly connected to work with local community (e.g. work with children potential, philanthropy work to unlock human potential, innovation, support charitable aims).

The intention of the research was to provide a wide range of generally accepted CSR and sustainable activities related also to SDGs, but without the ambition to generate universal CSR and sustainability checklist. However, this idea can be used for future research. Other ideas for future research are indicated in discussion, such as wider SDGs implementation, or reporting and information visibility.

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CSR of Socially Sensitive Sectors: A Case Study of Companies in the Gambling Industry

Abstract

The paper addresses the issue of corporate social responsibility (CSR) in one socially sensitive sector, namely the gambling industry. This is a pilot research study that aims not only to analyse the gambling industry and companies' approach to CSR, and to evaluate their projects and activities within this area, but also to formulate some CSR recommendations for these companies (specifically for a selected betting company). In the introduction, the paper outlines issues relating to the gambling industry and defines the concept of problem gambling, including important statistical data. It then describes the gambling market and its legislative aspects, and explains the concept of corporate social responsibility and its importance to the gambling industry. However, the main focus is on the CSR of a selected betting company, the integration of CSR into the company's long-term strategy as well as the specific activities and projects pursued by the company in this area. SAZKA a.s., the company that was selected to be analysed, is the leader in numerical and instant lotteries in the Czech Republic.

Key Words

corporate social responsibility (CSR), socially sensitive sectors, gambling industry, problem gambling, games of chance

JEL Classification: M14

Introduction

The gambling industry is among sectors that can be classified as socially sensitive or high-risk. In fact, business activities in the gambling industry are accompanied by a number of negative externalities that are mainly linked to the problems of pathological gamblers – financial problems and indebtedness, unemployment, crime, family breakdown, etc. However, it is also important to take into account some positive effects as this sector in providing significant revenue for public budgets, generating employment, and supporting many publicly beneficial activities – sports, culture, education, healthcare and others. In addition, it is also necessary to consider the primary purpose of the games, namely to have fun and be happy, the human need to compete or take risks, but also a certain need for excitement and desire for adrenaline. That said, participation in these games is voluntary and each gambler should only take a reasonable amount of risk. To some extent, companies and associations in the gambling industry contribute to the responsible behaviour of gamblers, for example through the principles of responsible gambling (Tetřevová, et al., 2017). However, while the responsible behaviour of players is essential, it is equally important to focus on the social responsibility of actual companies in the gambling industry, as they have ample opportunity to implement social responsibility.

1. Literature Review

Before we address social responsibility as such, it is necessary to start by mentioning and explaining the term “problem gambling”. Problem gambling (also known as pathological gambling or gambling disorder) means an inability to control gambling behaviour – this is characterised by a high intensity of gambling, an episodic character of gambling (limited to certain times), and substantial amounts of money spent gambling with subsequent negative impact on the gambler and their environment. According to estimates of the prevalence of problem gambling in the population, 5.7% of the adult population (510,000 people) were at risk, and 1.4% of the population (120,000 people) were at high risk in 2016. Problem gambling is, in turn, associated with social and health consequences. In 2017, a study of pathological gamblers showed that 70% of gamblers were suffering from some form of anxiety-depressive disorder, and 52% had suicidal thoughts. 76% of respondents admitted using addictive substances over the past year. A very serious socio-economic consequence of problem gambling is indebtedness. In 2017, problem gamblers who were registered in debt counselling programmes had an average debt of CZK 790,000. In 2017, 89% of the respondents in the study were in debt (Mravčík, et al., 2018).

Prevention in the area of gambling, specifically in the area of preventing the development of problem gambling, appears to be inadequate, despite the fact that this is a priority area of drug policy. In addition, some activities and measures to prevent the development of problem gambling must be implemented by actual operators of games of chance. For example, Act No. 187/2016 Sb., on gambling, introduced the obligation to offer self-restraint measures. However, gamblers lack adequate information about and, in turn, experience with these measures.

We will now briefly touch upon the legislative aspects of the gambling market in the Czech Republic. At the beginning of 2018, 60 companies had a license to operate games of chance in the Czech Republic. The gross earnings of the companies reached CZK 39.8 billion in 2017. Overall, the amount of tax paid on games of chance totalled CZK 12.1 billion in 2017 (Mravčík, et al., 2018). In the Czech Republic, the gambling industry is primarily regulated by Act No. 186/2016 Sb., on gambling, which has been in effect since 1 January 2017 and which superseded Act No. 202/1990 Sb., on lotteries and similar games, that no longer satisfied the requirements for gambling regulation. The new Act defines the various terms and regulates the general requirements for operating games of chance, as well as the legal restrictions and the authority of administrative bodies in the area of gambling.

In terms of CSR, measures focusing on responsible gambling are of importance. These measures are defined in two areas:

- self-restraint measures,
- a register of individuals excluded from gambling.

With regard to *self-restraint measures*, for those games where it is technically feasible the operator is required to offer the gambler self-restraint measures and allow them to individually set or individually refuse to set these measures. *The register of individuals excluded from gambling* is a non-public information system maintained by public administration in order to prevent excluded individuals' access to gambling. The register administrator is the Ministry of Finance of the Czech Republic.

2. Corporate Social Responsibility

The previous part of the paper outlined the negative aspects of gambling. It is these negatives that put the gambling industry in a bad light, not only for the public. The companies (gambling operators) should strive to counterbalance these negatives. However, the obvious positive effects of this line of business, i.e. the payment of money to public budgets, the creation of employment opportunities, etc., are insufficient. Companies are thus required to make additional efforts to improve not only their own image but also that of the industry as a whole. Corporate social responsibility (CSR) appears to be the ideal way of doing so.

There is no single definition of CSR. The European Commission Green Paper (2001) defines CSR as: *“a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis.”* In this paper, two additional definitions need to be presented. Putnová (2004) defines CSR as *“such corporate behaviours that take into account the needs of the company's internal and external environment in order to generally contribute to improving the overall condition of society, both within and beyond the scope of its business operations.”* According to the Business Leaders Forum (2010), CSR is *“a voluntary commitment of companies to behave responsibly towards the environment and society in which they operate.”* CSR thus contributes to increasing the credibility of the company in the eyes of its customers, business partners and society as a whole, improves the company's image and provides an opportunity for the company to distinguish itself from competition (strengthening the competitive advantage).

Two associations have been set up to support CSR activities within the gambling industry – APKURS (Asociace Provozovatelů KURzového Sázení, i.e. Association of operators of fixed-odds betting) and SPELOS (Sdružení Provozovatelů centrálních Loteriálních Systémů a dalších her, i.e. Association of operators of central lottery systems and other games) – bringing together the largest companies operating in the gaming industry. In general, this line of business can be divided into three areas: numerical lotteries, instant lotteries and fixed-odds betting. The remainder of the paper comprises a case study dealing with the company SAZKA a.s., which has a dominant share of more than 90% in both the numerical and instant lottery markets (Sazkove-Kancelare.com, 2018).

3. Case Study: CSR in the Gambling Industry

For this case study, the company SAZKA a.s. has been chosen as the largest and oldest lottery company in the Czech Republic. Founded in 1956, SAZKA has been offering scratch cards since 1989, and fixed-odds betting since 1995 (online fixed-odds betting has been available since 2009). In 2004, the SAZKA TICKET sales network for sports and cultural event tickets was established. In addition, SAZKA's non-lottery activities also include operating the services of virtual mobile operator SAZKAmobil, or enabling payments for services and goods. In 2017, the online gaming portal sazka.cz for lotteries and scratch cards was launched (SAZKA, 2018a). As mentioned above, SAZKA is the leader in both numerical and instant lotteries.

The company builds its long-term strategy on four basic principles. According to SAZKA (2018b) these are:

- *“Living the SAZKA brand.”*
- *“Committed to our cause.”*
- *“Looking for customers in all we do.”*
- *“Helping by growing.”*

The last principle – “Helping by growing” is the one that forms the cornerstone of SAZKA’s CSR Strategy. It is based on long-term conceptual work and a clearly defined CSR strategy, which is part of the company’s long-term strategy and whose activities are oriented towards the Czech Republic as its place of business (SAZKA, 2018c). With respect to the different CSR pillars and SAZKA a.s., it needs to be noted that the company does not address the Environmental pillar separately. Given its line of business, the company’s environmental impacts are not significant and it does not deem it necessary to address this area in detail. Therefore, only the two remaining CSR pillars – Economic and Social are addressed below.

3.1 Economic pillar of CSR

Every year, the transparency of business activities is reflected in the company’s annual report. The company’s profit was selected as the main indicator. According to the Annual Report (2018), profit after tax totalled 972,313 thousand CZK. In 2015, the CRM Department was established to manage customer relationships, and to increase customer value and satisfaction. Furthermore, modern information and communication tools (especially online) are also used to ensure good customer relationships (Annual Report, 2015).

3.1.1 Responsible gaming

The company considers responsible gaming and all related activities to be an integral standard of the lottery industry. The company fully respects the regulatory framework that should strive for a long-term sustainable structure of the gambling industry and protect the market from illegal providers (SAZKA, 2018d).

SAZKA is aware of its responsibility and, as the market leader, wants to set an example. Therefore it considers proactive involvement in primary prevention as absolutely crucial. This aims to prevent problems associated with the occurrence of socially pathological phenomena in gambling addictions. Members of SAZKA a.s. take part in expert discussions on the risks of gambling in the Czech Republic, which are hosted by the National Monitoring Centre for Drugs and Drug Addiction, an organisational part of the Secretariat of the Government Council for Drug Policy Coordination (SAZKA, 2018e).

In 2017, SAZKA committed itself to meeting international standards of a responsible approach, which involves a comprehensive system of rules, including verification of compliance. In some cases, these standards even go beyond the national legal framework. SAZKA has met the requirements of the European Lotteries (EL) association and has been awarded the Responsible Gaming Certificate of Alignment. At the same time, it has received the highest level (Level 4) Certificate of WLA (World Lottery Association)

Responsible Gaming Framework. Among other things, the requirements include the security of buildings and technology, the safe handling of information and data, management of security incidents, the quality of training processes, the level of legal services and the handling of complaints. The certificates that have been obtained therefore attest that SAZKA a.s. has adopted and continuously develops an information security management system in line with international standards, and fully complies with the principles and security requirements of the lottery industry (SAZKA, 2018e).

In addition, the company's website also features a telephone number and an e-mail address for a contact centre, and a 'help map' showing addictology centres in the Czech Republic that provide professional assistance. Responsible gaming also includes gambler limits (i.e. the self-restraint measures mentioned above). Also very important is the definition of the ten Responsible Gaming commandments; according to SAZKA (2018f) these are:

- 1. Play to have fun. Never bet more than you can afford, never bet borrowed money.*
- 2. Set your gaming limits.*
- 3. See betting as fun, not as a means of getting rich instantly.*
- 4. Do not play if you are under the influence of alcohol, stress or depression.*
- 5. Be prepared to win, be prepared to lose.*
- 6. Keep your entertainment and excitement under control – be aware of time, the amounts at play, and both winnings and losses.*
- 7. It is chance and luck that decide; never believe any tricks, fraudulent instructions or systems.*
- 8. Study each game, its benefits and risks. Choose the ones that suit you best.*
- 9. Bet and play only where the law and clear and correct rules are respected.*
- 10. Observe the law, get to know the rules of the game, and follow them. Follow the rules of the betting company and gaming centre.*

3.2 Social pillar

Within the social pillar, the company mainly pursues various CSR activities and projects in areas such as supporting sport and culture (SAZKA, 2018b), e.g.:

3.2.1 Sport

Sazka Olympic Multicontest – the project was set up in September 2014 in collaboration with the Czech Olympic Foundation and it aims to attract as many Czech schoolchildren as possible to sports, and to show them sports as a fun and integral part of life. In 2016/17, 1 227 schools were involved in the project, representing more than 150 000 children. Thanks to the project, children can discover their strengths in sports and get training tips and specific recommendations for sports.

Helping children do sports – thanks to partnership with the Czech Olympic Foundation, SAZKA supports athletes aged 6–18, who come from socially disadvantaged families or children's homes and thus lack sufficient financial resources to do sports. The project contributes funds for specific items such as sports equipment, sports courses and clubs, training camps, and membership fees. Over the 5 years of the foundation's existence, a total of 1,865 children have been supported, with contributions totalling almost CZK 11 million. Support for sports activities of children and the youth is linked to the fact that SAZKA does not pay taxes to the government, but rather directly to the Czech Olympic

Committee, which then distributes these funds exclusively for the purpose of developing children's and youth sports, especially amateur sports.

General Partner to the Czech Team – SAZKA is also a general partner to the Czech Olympic Team and is involved in the preparation of top Czech athletes. The goal is to create the best conditions possible for athletes, which are on par with those of the strongest foreign teams. Support mainly includes the provision of service and expert know-how for top athletes. This sponsorship thus helps boost the company's image and set it apart from competition.

Sports in the neighbourhood – this is another project of SAZKA and the Czech Olympic Committee. It operates of the largest public database of sports clubs and calendar of sports events. On the sportvokoli.cz website, there are 15,000 sports clubs that can be filtered by type of sport or location. Also, there are tips and recommendations on how to take up any sport, and opportunities to register for recruitment for the various sports clubs.

3.2.2 Culture

To a lesser extent, SAZKA a.s. also supports culture. As a Czech company, it believes in the country's traditional cultural values, including music as a major part of its cultural heritage. Therefore, it supports projects to support both traditional classical music and new alternative genres.

Dvořák Prague – presents international audiences with an opportunity to enjoy the music of one of the best Czech composers, Antonín Dvořák, as well as other international composers. The festival is famous for the quality of both its programming and artists, including many of the world's leading soloists, conductors and orchestras.

The St. Vitus Organ Fund – this is one of SAZKA's newest initiatives (since 2015). The St. Vitus Organ Fund oversees the project of a new organ for the St. Vitus Cathedral at the Prague Castle. The new organ is supposed to bring the quality of both liturgical and concert events to a world-class level.

Strings of Autumn – taking place since 1996, this is a music festival whose program can reach a wide audience and help expand musical horizons. The festival's significance was perfectly summed up by Václav Havel: "*The Strings of Autumn experiments with dramaturgy in ways that are both bold and rare.*" The US newspaper New York Times has described the Strings of Autumn as one of the most innovative music projects in Prague (Strings of Autumn, 2018).

3.3 European gaming market

The European Gaming and Betting Association (EGBA) is the Brussels-based trade association representing the leading online gaming and betting operators, established, licensed and regulated within the EU. EGBA works together with national and EU authorities and other stakeholders towards a well-regulated online gambling market which provides a high level of consumer protection and takes into account the reality of the digital economy and consumer demand. EGBA's member companies together represent more than 12 million consumers in Europe, with demand for their innovative digital entertainment services continuing to grow each year.

Key figures for 2017 (EU market):

- Online gambling had a 20.7% share of the total EU gambling market activity, while 79.3% was land-based, including lotteries, casinos and bookmaker shops.
- The online share of the gambling market is expected to grow to 24.9% in 2020.
- Sports betting (40.3%) was the most popular form of online gambling in Europe, followed by casino games (32.1%), lottery (13.3%), poker (6.1%), bingo (4.6%), and other games (3.6%).
- The economic size (or gross profit) of the EU online sector is expected to rise from €19.6 billion in 2017 to €24.7 billion in 2020.

EGBA and its CSR Social Pillar:

Sports sponsorship - EGBA members contributed €325 million in financial support to sports federations, leagues and clubs through sponsorships, advertising and sports rights.

Jobs - EGBA members have established offices in 14 different EU countries, employing more than 33,000 people, from a range of nationalities, in digital and high quality jobs.

Know Your customer - EGBA companies invested more than €22.6 million in Know Your Customer checks, which enable identity verification and help to prevent minors from gambling (EGBA, 2018).

4. Discussion

Social responsibility is part of the SAZKA's long-term strategy. One of the company's four basic principles is directly related to CSR. CSR activities then mostly focus on sports, but also on culture and responsible gaming. In terms of CSR, SAZKA as the leader in both numerical and instant lotteries in the Czech Republic sets a good example for its competitors and followers.

Corporate social responsibility is an area that will grow in importance and be increasingly monitored by the public in the coming years. Therefore, SAZKA a.s. should definitely continue to address CSR, pursue additional activities and support additional projects, whether in sports and culture (as mentioned above) or possibly in other potential sectors. However, responsible gaming should be the most important area. The company should continue and deepen its collaboration with the National Monitoring Centre for Drugs and Drug Addiction, participate in expert discussions on topics relating to the risks of gambling, monitor current statistics concerning problem (and especially pathological) gambling, and seek to prevent the problems of these gamblers. It is the area of prevention and subsequent treatment that SAZKA a.s. should focus most of its attention on (just as the EGBA does). The potential activities to be pursued in this area should definitely include regular retraining for employees, e.g. in order to be able to recognise and subsequently help pathological gamblers (by referring them to appropriate addictology centres).

Conclusion

It was found that the selected company SAZKA a.s. has incorporated CSR into its long-term strategy and, moreover, considers this area to be of the utmost importance. For the time being, the activities pursued and projects supported are adequate and help improve the company's reputation in the gambling industry, which is otherwise viewed rather

negatively by the general public (due to negative externalities). SAZKA a.s. currently focuses primarily on supporting sports, especially for youth and top athletes, and culture. Also, recommendations have been proposed to the company that should be implemented in order to improve the effectiveness of CSR activities – namely: delivering employee training and expanding support for prevention (EGBA could be the model example).

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Section II

Entrepreneurship and Innovation

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The Earnings Expectations of Business Economics Students in the Czech Republic and England: the effect of seniority

Abstract

While the financial returns to education have been widely studied since the 1960s, the research on students' earnings expectations is relatively scarce. This study investigates the effect of student seniority on their earnings expectations and their perceptions of the link between education and labour market outcomes. Business economics students were surveyed at two universities in England and two universities in the Czech Republic. A mixed-methods approach was used – questionnaires and focus groups - for data collection. First year students expected to earn more on average compared to their final year counterparts, both immediately after graduation and ten years later. Students expected their earnings to grow with education and experience. Students expected to earn more after graduation compared to what they would expect had they decided not to go to university. Final year English students who expected to achieve a first class honours degree had higher expectations compared with the rest of the sample. In both countries, final year students who expected to be overeducated after graduation anticipated a pay penalty. Final year students believed they would have been financially punished for leaving university during their final year. Students who intended to stay in their home regions after graduation had lower earnings expectations compared to those who were willing to relocate to the capital city or move abroad.

Keywords:

Earnings expectations, students, business schools, Faculties of Economics, Czech Republic, England

JEL Classification: I21, I26

Introduction

There is abundant literature on the financial returns to education. However, most studies have estimated the rates of return by using actual earnings data. According to human capital theory, young people will enter higher education if the expected gain in earnings exceeds the cost of obtaining a degree (Gemmell, 1997). However, due to the reluctance of economists to use subjective data, research on students' earnings expectations is limited (Dominitz and Manski, 1996). While young people go to university for a variety of reasons, better career prospects and an increase in their earnings potential are undoubtedly some of the most important motivations behind the decision. Therefore, it is important to understand how students form their earnings expectations (Manski, 1993).

This study compares earnings expectations of first year and final year students. Previous research has identified the impact of students' personal characteristics (e.g. gender and social class); however, students' seniority (i.e. proximity to graduation) has been largely overlooked. The positive association between supervised work placements and graduate earnings is well documented in the literature (HEFCE 2009; Papadatou, 2010); yet no study on students' expectations has included this factor. Thus, the effect of casual work experience and supervised work placements on earnings' expectations is analysed in this study. British graduates with a first class degree and those who have completed a Master degree have been found to have higher earnings (Conlon and Patrignani, 2011; Walker and Zhu, 2011; Lindley and Machin, 2013); therefore in this study students' earnings expectations are evaluated in the light of their expected final grade and their expectations regarding Master studies.

The aim of this study is to examine and compare students' earnings expectations and explore their perceptions of the link between educational credentials and labour market outcomes. The objectives of this study are: to compare how earnings expectations vary among students both within and between countries; to examine the effect of education (including the level of education, university prestige, expected final grade, expected postgraduate studies, over education and study abroad) on students' earnings expectations; to determine what is the impact of students' work experience (including casual and supervised work experience) on their graduate labour market expectations to examine whether there is any evidence of a "sheepskin effect" in students' earnings expectations.

While the body of literature on students' earnings expectations is growing slowly, most studies have focused on students within one country. This study focuses on the first year and final year students on business programmes at two universities in England and two in the Czech Republic. There are two reasons for CIPD comparing these two countries. Firstly, there is a difference in how higher education is funded. While studying at Czech public universities is free of charge, students in England pay on average the highest tuition fees in the world (OECD, 2015). Secondly, the incidence of so called "over education" in the UK is high, with increasing number of graduates entering non-graduate jobs (CIPD, 2015; Office for National Statistics, 2016). By contrast, the incidence of over education in the Czech Republic remains one of the lowest among European countries (Barone and Ortiz, 2010; Verhaest and Van der Velden, 2013).

1. Methods of the Research

The population in this research was first year and final year English Bachelor students studying at Business Schools in two universities in England (denoted as UNIA and UNIB) and first year Bachelor and final year Master students studying at two Faculties of Economics in the Czech Republic (denoted as UNIC and UNID). In England, Bachelor degree holders are considered ready for the job market, whereas in the Czech Republic, it is Master qualified students who are considered graduates. The institutions involved in this project were chosen based on their accessibility– existing contacts were used to gain access (i.e. convenience sampling). The survey took place between the academic years 2011/2012 and 2014/2015. The sample represented more than 50% of the population of first year students in all academic years. The sample size varied more for final year students from year to year. Previous studies have used almost exclusively a cross-

sectional study design; thus collecting data only at a single point in time. While this study is not truly longitudinal it does use a repeated cross-sectional design. As a result, it is possible to detect changes in earnings expectations between cohorts.

All students who attended selected lectures had a chance to answer a questionnaire. The response rate was very high; however, those who were absent from the lecture did not have another chance to complete the questionnaire. Students were not informed in advance about the data collection which implies that the survey did not influence lecture attendance. However, students' ability and motivation could have an impact on attendance. For instance, some students might not be able to attend lectures due to employment and family commitments. On the other hand, students who are highly motivated (both intrinsically and extrinsically) are more likely to attend lectures (Kottasz, 2005). Since convenience sampling was used some members of the population had a zero chance of being selected. As non-probability sampling was used the findings can be considered indicative but not definitive.

Three focus groups of students were conducted in England and three in the Czech Republic. Each focus group consisted of either first year or final year students who were attending the same study programme. Students knew each other from classes and seemed to be relaxed during the discussion. They were willing to share their opinions and experiences. Nevertheless, any topic can be sensitive to participants and the sensitivity of a topic is not fixed but socially constructed (Farquhar and Das, 1999). Students who took part in focus groups were a subset of the survey respondents. The initial invitation to attend a focus group was sent by university email. However, some students were informed directly in class. Only those students who showed interest and confirmed their availability received the final invitation. One can assume that students who volunteered were more confident and opinionated than the "average" student (Denscombe, 2002).

Large data sets from completed questionnaires were analysed using the statistical package PASW. Each response to each question was first coded as a number and manually inputted into MS Excel and then the complete data sets were loaded into the PASW.

2. Results of the Research

Table 1 presents the structure of the sample by the academic year, institution and level of studies. In total, there were 2,970 respondents included in the sample. Only students who stated their nationality as British/Czech were included in the data analysis. Data from international students were collected but excluded from the analysis. There were a few students in the English sample who were born abroad but settled in the UK. Those of them who stated their intention to stay in the country after graduation were included in the sample.

Descriptive data analysis was carried out to find any differences between the countries. The analysis revealed an unequal gender distribution – the Czech sample was dominated by female students while male students were a majority in the English sample. Czech students were slightly older on average because the "high school" leaving age is higher in the Czech Republic. Czech students were also more willing to relocate after graduation and were more likely to have a part-time job during their studies. Nevertheless, despite

their greater mobility and work experience they were less optimistic about finding a graduate job.

Table 1: Structure of the sample

Academic year	Level of study	UNIA	UNIB	UNIC	UNID	Total
2011/2012	First	260	121	98	0	479
	Final	96	60	47	58	261
	Total	356	181	145	58	740
2012/2013	First	281	73	90	0	444
	Final	67	89	81	61	298
	Total	348	162	171	61	742
2013/2014	First	239	82	133	0	454
	Final	54	54	0	96	204
	Total	293	136	133	96	658
2014/2015	First	263	0	114	189	566
	Final	139	0	77	48	264
	Total	402	0	191	237	830
	Grand Total	1,399	479	640	452	2,970

Descriptive data analysis was carried out to find any differences between the countries. The analysis revealed an unequal gender distribution – the Czech sample was dominated by female students while male students were a majority in the English sample. Czech students were slightly older on average because the “high school” leaving age is higher in the Czech Republic. Czech students were also more willing to relocate after graduation and were more likely to have a part-time job during their studies. Nevertheless, despite their greater mobility and work experience they were less optimistic about finding a graduate job.

In England, the data for this study were collected from Business School students at two post-1992 universities. UNIA is situated in the Yorkshire region and UNIB is located in the West Midlands. UNIA is larger with over 20,000 students, UNIB has over 15,000 students. In the Czech Republic, the data were collected at two Faculties of Economics. UNIC is a technically-oriented public university located in northern Bohemia. The Faculty of Economics at UNIC is the only one within the region and has around 1500 students. UNID is also a public university specialising in technical and economic subjects. The Faculty is situated in the Moravian-Silesian region of the country and it is one of the largest Faculties of Economics. In terms of their prestige, UNIC and UNID occupy a similar position in the Czech university league tables. While some contrasting results were obtained from the Czech and English samples, not many differences were discovered between the universities in the same country.

There was very little difference in the gender of the respondents of UNIA and UNIB. The ethnic composition was similar - White British students formed the majority at both UNIA and UNIB, followed by Asian British students. Parents of students at UNIB tended to have higher levels of education and higher earnings. There were no significant differences in expectations between the UNIA and UNIB samples. Around two thirds of final year students expected to be in a graduate job six months after graduation (68% of respondents at UNIA and 66.5% of respondents at UNIB). Less than one fifth of students expected to be either unemployed or working in non-graduate level jobs (16.3% of respondents at UNIA and 17.7% of respondents at UNIB). The number of students

considering Master studies was low – 6.2% at UNIA and 8.9% at UNIB. Respondents at UNIA and UNIB had similar expectations of graduate labour market prospects and their expected graduate job destinations were very similar. One significant difference between UNIA and UNIB is the proportion of students who undertook a supervised work placement in the third year of their programme (39.9% and 14.8% respectively). This may explain the higher number of students at UNIA who expected to achieve a first class honours degree.

There was no notable gender difference between UNIC and UNID. While parental education was similar, students at UNID reported lower parental income which could be due to regional pay disparities. A higher proportion of students at UNIC considered working in Prague after graduation probably due to the region's proximity to the capital. The most contrasting result was the number of students who had studied abroad – the participation rate at UNIC was 16.1% compared with 5.7% at UNID.

It is noteworthy that students in the English sample did not expect to reach the national median earnings (i.e. £27,600 p.a. for the tax year 2014/2015) immediately after graduation. Czech students, on the other hand, expected their starting graduate earnings to be higher than the national median earnings (i.e. Kc23, 726/month for the calendar year 2015). However, no such difference is apparent in expectations 10 years after graduation. In this scenario both Czech and English students expected their earnings to be above the 75th percentile point which was Kc31,627/ month in the Czech Republic and £33,900 p.a. in the UK (Ministerstvo Práce a Sociálních Věcí, 2016; HM Revenue & Customs, 2016). Both English and Czech students valued ten years work experience more than a degree. In both samples, students' median earnings expectations were higher with the 10 years' work experience without degree scenario (MEWD10) compared to the immediately after graduation with a degree scenario (MEAG). The difference was more noticeable in the English sample.

The seniority of students (i.e. proximity to graduation) is linked to their earnings expectations. Tables 2 and 3 show that the average earnings expectations of first years and final year students in both countries. One has to bear in mind that final year English students involved in this study were pursuing a Bachelor programme while their Czech counterparts were completing a Master degree.

Table 2: Students' seniority and earnings expectations: English sample

Earnings Expectations (£/p.a.)	First year students	Final year students
MEAG	23170	20877
MEAG10	42002	39828
MEWD	16088	16293

Table 3: Students' seniority and earnings expectations: Czech sample

Earnings Expectations (Kc/month)	First year students	Final year students
MEAG	22280	19877
MEAG10	34370	32304
MEWD	15546	17177

First year students in both countries expected to earn more than final year students immediately after graduation (MEAG) and ten years' later (MEAG10). Immediately after graduation, first year English students expected to earn 11% more compared to their final year counterparts. The difference in the Czech sample was 12.1%. Final year students (both Czech and English) had slightly higher expectations under the MEWD scenario.

During the focus groups, students were asked how much they would expect to earn in their first graduate job (i.e. MEAG scenario). In general, final year students seemed to be less optimistic about their graduate labour market prospects and expected lower starting salaries than their first year counterparts which is in line with the results from the quantitative analysis. In the Czech Republic, final year students (UNID) suggested an initial salary of Kc16, 000/month. This group believed that a low starting salary was almost inevitable due to high regional unemployment figures and a shortage of graduate employers within the region. Amongst the first year students at UNID, the lowest expected salary was Kc15, 000/month and the highest was Kc 25,000/ month. In the English sample, the answers from the first year students at UNIA ranged from "nothing exceptional" and "minimum wage" to £20,000p.a. The answers of final year students at UNIA depended on their work experience. While those who had completed a supervised work placement (i.e. a four-year Bachelor degree) expected at least £20,000 p.a., those pursuing a standard three-year course expected £15,000-£17,000 per annum. Although the sample size was small, the answers are consistent with the survey results that showed higher earnings expectations for first year students in the MEAG scenario.

3. Discussion

It is debateable whether or not students can meaningfully predict their future earnings. For instance, Jerrim (2008, 2011) found that UK full-time students overestimate their average starting salaries by approximately 15%. Therefore, it is useful to first compare students' earnings expectations with the realised salaries of recent business studies graduates. The average starting salaries for recent business graduates at UNIA and UNIB were £18,800 p.a. and £19,000 p.a., respectively. Students who participated in this study had higher expectations. Students at UNIB anticipated an average salary of £21,519 p.a. immediately after graduation which is 13.3% more compared to the salaries of recent graduates. Their counterparts at UNIA expected to earn £22,819 p.a.; thus "overestimating" the starting salary by 21.4%. It is more difficult to evaluate the accuracy of the Czech students' earnings expectations since there is no available data on graduates' starting salaries. A longitudinal study focusing on the average earnings of graduates five years after graduation has been published; however, this study used a self-selected non-probability sampling which means its participants might not be representative of the entire graduate population. According to its results, graduates from UNIC earn on average Kc 35,371/month five years after graduation; by contrast, the average earnings of those who graduated from UNID are notably lower at Kc 26,453/month (Kvačková, 2015). In other words, graduates from UNIC earn 33.7% more on average compared to graduates from UNID. At UNIC the average expected earnings immediately after graduation (MEAG scenario) and ten years after graduation (MEAG10 scenario) were Kc 22,259 /month and Kc 34,205/month, respectively. Students at UNID expected to earn Kc 19,862/month under the MEAG scenario and Kc 32,466/month under the MEAG10 scenario. The difference in expected earnings between UNIC and UNID was 12.1% for the MEAG

scenario and 5.4% for the MEAG10 scenario. Thus students' expectations did not reflect the differences in realised graduate salaries. To explain this discrepancy, it has been suggested that students have a good understanding of the graduate labour market but they tend to distort their own future salary (Jerrim, 2011; Menon et al., 2012). Alternatively, as pointed above, the data on realised earnings of Czech graduates may not be accurate due to self-selection bias.

It is also noteworthy that students' expectations did not increase significantly over the years, as one might expect. On the contrary, the first cohort of students (surveyed in 2011/2012) had the highest expectations for some scenarios (namely MEAG10 and MEWD in the English sample and MEAG and MEAG10 in the Czech sample). In the English sample, the increase in expected starting graduate salaries was only 2.3% between the academic years 2011/2012 and 2014/2015. One of the possible explanations is the effect of the global financial crisis and resulting uncertainty. According to the OECD (2014), wages were stagnant across the OECD countries between 2010 and 2013 and the real (inflation-adjusted) wages fell in the UK during that period. Real earnings started to recover in 2015 when they grew by 2.8% (Cadman, 2015). Therefore, students' earnings expectations during the survey period seem to reflect the labour market situation. Moreover, students in England who started their study programmes in 2012/2013 or later had to pay higher tuition fees; yet their earnings expectations were very similar to those who started their studies prior to 2012. These findings could imply that in England the perceived value of a Bachelor degree has declined since 2012/2013. Czech students' expectations were also very similar across the surveyed years. Again, the consequences of the financial crisis could help to explain this finding. In terms of real wage growth, the Czech Republic also experienced a sharp deceleration between 2008 and 2015 (OECD, 2016). Another possible explanation could be the increasing number of young people entering higher education – the Czech graduate labour market might be reaching saturation point. Indeed Czech students who participated in the focus groups expressed their concerns about the increasing number of graduates and its impact on the labour market.

Conclusions

The aim of this study was to investigate the earnings expectations of business economics students in England and the Czech Republic. Students expected to earn significantly more after graduation compared to what they would expect had they entered the labour market with high school leaving qualifications (A-levels/Maturita) only. High achieving English students (i.e. those expecting to achieve a first class degree) believed they would be rewarded in the labour market for their efforts. Czech students who spent part of their studies overseas expected to earn more after graduation although the difference was not found to be statistically significant. University prestige also played a role in students' labour market expectations. Final year students who expected to be overqualified i.e. be in a non-graduate job six months after graduation expected to incur a pay penalty. There was also evidence of a sheepskin effect in students' expectations – final year students believed they would be financially penalised if they had to leave university without a diploma. Students believed that their future earnings would grow with accumulated work experience. English final year students who undertook a supervised work placement expected to earn more 10 years after graduation. The place of study was found to have a negligible effect on expected earnings. However, both Czech and English students who

intended to stay within their home region after graduation had the lowest expectations compared to those who planned to relocate within the country or to move abroad. English students had higher expectations compared to their Czech counterparts even when the different price levels between the two countries is taken into account.

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Credibility Modelling for Extreme Losses of Natural Hazards in Czech Republic: An Actuarial Approach

Abstract

Credibility theory is an actuarial approach that is used to calculate insurance premiums. The aim of this article is: to calculate the credibility premium based on real data collected from non-life Czech insurance industry. The Czech insurance market is affected badly by the natural hazards which in many cases have high losses. In this research an empirical study is carried out to calculate the credibility premiums during the period from 2006 to 2018. The past data are collected from Czech nonlife insurance market taking into consideration the amount of three highest risks areas and the number of extreme losses in each area. Bühlmann and Bühlmann-Straub credibility models are used to estimate the net credible premium for the following year as a linear function of the prior claims and the number of extreme losses. This multivariate model allows to estimate the conditional mean square error of prediction for the credibility predictor of the ultimate claim. The three areas of natural hazards under study will be analyzed and the credible premium in each area will be estimated. Taking into consideration the number of extreme losses, the results of this paper can be a good guidance to the Czech insurance industry in the case of occurring of extreme losses in natural hazards.

Key Words

credibility theory, credibility premium, Bühlmann and Bühlmann-Straub credibility, extreme claims

JEL Classification: C13, C52, C58

Introduction

The credibility theory was first developed by Bayes in 1763. Many researchers have been working to develop the theories and the models used to reach more accurate method of calculating the risk premium that should be collected by the insurers based on conditional probability.

Later, Bühlmann and Bühlmann-Straub credibility approaches are considered as recent development of the Bayesian credibility theory; these models apply the greatest accuracy theory. Bühlmann introduced his model in 1967 and this work was followed by

Bühlmann-Straub who continued the earlier work of Bühlmann and introduced a multivariate generalization of the credibility model for claim reserving.

Czech Republic faces high losses caused by natural storms and floods over recent years, the Czech insurance market has experienced extreme losses of natural hazards that would affect the calculation of premiums to cover the expected liabilities in occurrence of such risks. Since credibility theory provides an actuarial approach to deal with these extreme losses, it will be important to explore the implementing of credibility models in such risks. Both Bühlmann and Bühlmann-Straub models introduced the credibility models that can be helpful in calculating the premiums required to cover such losses.

In this paper, we are going to use a modified model based on the Bühlmann and Bühlmann-Straub models to project the premiums based on the past /posterior data of extreme losses by natural hazards which were collected from the Czech insurance market from 2006 to 2018. The paper starts with introducing a brief description of the Czech insurance market, then followed by presenting and describing the model used of both Bühlmann and Bühlmann and Bühlmann and Bühlmann-Straub. In the fourth section, the analysis and results will be presented according to the modified credibility model that is used to project the premiums. Finally, we will conclude the main results of the paper and the future work.

1. Czech Insurance Market

Insurance Companies

According to the Czech National Bank (CNB, 2019a), there are a total of 48 entities operating on the domestic insurance market, including 14 domestic insurers, 14 foreign controlled insurance undertaking and 20 branches of foreign insurance undertakings, in 2019. According to the type of coverage, they are classified into 8 life insurance companies, 27 non-life insurance companies and 13 composite insurance companies.

Insurance Market Structure

In year 2018 (CNB, 2019b), (CNB, 2019c), the share of life insurance in total premiums written was 36.14% and the non-life insurance was 63.86 %. Unlike other developed western countries, the ratio of the two main segments has been stabilised at 60:40 with the prevalence of life insurance, however, non-life insurance currently prevails in a similar ratio in the Czech Republic.

In life insurance, the premiums written covered the following branches: the unit-linked insurance becomes very popular and has more than 50% of the share of the life insurance market (exactly 51.1% in 2017, (CIA, 2018)). It is followed by a share of 26.8% for the supplementary accident or sickness insurance. The insurance policies that provide benefits of death and survival was in total 20.6% divided as follows: 12% was the share of insurance on survival or survival/death, 5.8% was the share of insurance on death,

2.8% was the share of pension insurance. Finally, only 1.5% of the premiums written was for other insurance coverages such as: marriage insurance, capital operations and others¹.

In non-life insurance, the share of premiums written in both the motor third-party liability insurance and the property insurance is the largest with 24.2% and 23.6% respectively in 2017 (CIA, 2018). it is followed by the share of motor damage insurance – ground means of transportation with 20.0%. The smallest share of the non life insurance market is 16.4% of general liability insurance² and 15.8% for other types of non-life insurance.

Czech Insurance Sectors

By the Czech insurance law – Act No. 277/2009 Coll. Insurance act, there are the following life and non-life insurance sectors:

For life Insurance:

I. Insurance:

(a) in the event of death, survival, survival of a specified age or earlier death, associated lives, payment of the premium paid;

(b) pension;

(c) accident or sickness insurance as ancillary insurance.

II. Wedding insurance or insurance for child nutrition.

III. The insurance which are linked to the investment fund.

IV. Permanent health insurance.

For non-life insurance (groups):

I. accident and sickness insurance;

II. motor vehicle insurance;

III. marine and transport insurance;

IV. aviation insurance;

V. insurance against fire and other property damage;

VI. liability insurance;

VII. credit and guarantee insurance;

VIII. cumulative non-life insurance.

In the Czech Republic, natural disasters are divided into three basic groups:

- damage caused by the weight of snow;
- damage caused by the floods;
- damage caused by gales and hail storms.

¹ This shares are including one-tenth of single-payment life insurance.

² General liability insurance including statutory workmen's compensation.

The most destructive natural disasters result are from floods. One of the historically greatest floods was of July 1997 in Moravia and Silesia which took 52 lives and caused damage in excess of 63 billions CZK. Another biggest flood was in Bohemia in August 2002, which took 19 lives and damage ran was over 70 billions CZK (CIA, 2019). As the insured damages amounted to staggering amounts, it is therefore essential for the insurance market to include modeling of possible future damages in basic research.

2. Credibility Models

Background

Credibility theory was derived by Bayes (1763) during the 18th century. In the second half of the 20th century, Bühlmann (1967) and Bühlmann-Straub (1970) developed a multivariate generalization of the credibility model for claim reserving. This was helpful to the insurance companies which were interested in using these models to help in reserves calculations and pricing of the policies offered. They were also interested in the application of the credibility models on the catastrophic claims by studying the tail behaviour of the distribution of claims.

Over years and up-till now, many researchers have been working and developing the credibility models. In recent years, Atanasiu (2005) applies Bühlmann–Straub model to measure the credibility net premium. Boland (2007) uses Bayesian analysis in insurance and actuarial sciences and R package as statistical software to analyse the empirical results. Linda and Kubanová (2012) apply Bühlmann-Straub credibility model using real data from five insurance companies to calculate premiums for motor third-party liability insurance.

Loisel and Trufin (2013) consider the discrete-time ruin model to determine the characteristics of the ruin probability in the heavy tailed claim amounts applying the Bühlmann credibility to estimate the net premiums. Pacáková (2013) applies Bayesian credibility analysis to estimate parameters of different statistical distributions with given prior distribution and use this estimation to project the premium and number of claims in insurance.

Happ et al, (2014), apply Bühlmann-Straub credibility to claim reserving nonlife chain-ladder using multivariate credibility model of N correlated portfolios. Later, Gao (2016) illustrates modelling claim reserving using Bayesian analysis, in this study, a compound model, as a probabilistic approach, is proposed and Bayesian expansion models are illustrated by applying Monte Carlo simulation for claim reserving.

Furthermore, Jindrová and Kopeck (2017), consider Bühlmann and Bühlmann-Straub empirical credibility models to estimate the net premiums of catastrophic claim amounts and economic losses in different regions. Hendrych and Cipra (2017) demonstrate the dynamic linear system of simultaneous equations in non-life insurance market in Czech; they use this system to estimate the desired variables, i.e.; outstanding claims, unearned premiums and other technical loadings. This approach used might motivate developing of other models that could be applied in the Solvency II framework.

Bühlmann and Bühlmann-Straub Credibility Models

In this paper, we will focus on applying the Bühlmann and Bühlmann-Straub credibility models. The approach that is used by ElSayed and Soliman (2019) will be adopted to project the net credible premium for non-life insurance in Czech. They developed a joint distribution of the claim amounts and the number of observed extreme losses, in order to predict the upcoming year net credible premium and apply the joint model in six branches of non life insurance in Egypt from 2006 to 2015. Taking into consideration that the tail behaviour of loss distributions is demonstrated by extreme events, they use a modified Bühlmann and Bühlmann-Straub credibility models where the tail behaviour of claims in order to predict credible premiums is considered.

The aim of this paper is to use the modified Bühlmann and Bühlmann-Straub credibility models in order to estimate the net credible premium for as a linear function of the prior claims and the number of extreme events, and test them in different branches of non life insurance market and in different economy like the insurance market in Czech Republic.

The data from the non life insurance market is collected and it is mainly related to the natural hazards. The reason behind the application of the models in the natural hazards is that the natural hazards are considered the most effective extreme losses in the Czech insurance market. They have the catastrophic behavior and it is highly damaging to the community. This has a direct effect on the economy and may result to high losses that the insurance market can not deal with. The available data that will be used as past data to predict the net premium is from 2006 to 2018 which is reported by Czech Insurance Association.

The statistical distribution of each branch will be developed to describe the statistical characteristics in each one of them. A simulation of the incurred claims will be run to reach the main parameters of the number of extreme losses with application of the Bühlmann-Straub credibility model. This application will lead to predict the net premium as a linear function of the prior claims and the number of extreme events.

The Bühlmann credibility model assumes that statistical distribution, random variables $\{X_1, X_2... X_N, X_{N+1} ...\}$ are independently and identically distributed (*i.i.d*).

As mentioned above the credibility premium consists of two ingredients, then

$$C = Z P_r + (1 - Z)\mu \quad (1)$$

where C represents the estimated pure premium, P_r referred to the estimation based on the prior data for each branch and Z is the credibility factor which is a number between 0 and 1 that measure how much reliance the insurer is ready to face its own risk.

The Bühlmann credibility approach estimates the credibility premium from each risk; this model has been derived in Bühlmann (1976), and concluded the following results

$$E(m(\theta)|x) = Z \bar{x} + (1 - Z)E(m(\theta)) \quad (2)$$

and the credibility factor

$$Z = \frac{n}{n + \frac{E(s^2(\theta))}{VAR(E(m(\theta)))}} \quad (3)$$

where $E(m(\theta))$ is the collective premium, $E(s^2(\theta))$ is within risk variance and $VAR(E(m(\theta)))$ between risk variance.

In Bühlmann-Straub Credibility Model (1970), the estimation of the net premium for the i -th risk was expressed as follows:

$$E(m(\theta)|x) = Z_i \bar{X}_i + (1 - Z_i)\bar{X}, \quad (4)$$

where the credibility factor for each i risk Z_i is calculated from the formula

$$Z_i = \frac{P_i}{P_i + \frac{E(s^2(\theta))}{VAR(E(m(\theta)))}}, \quad (5)$$

where

$$E(s^2(\theta)) = \frac{1}{N(n-1)} \sum_{i=1}^N \sum_{j=1}^n P_{ij} (X_{ij} - \bar{X}_i)^2 \quad (6)$$

$$VAR(E(m(\theta))) = P^* \left\{ \frac{1}{nN-1} \sum_{i=1}^N \sum_{j=1}^n P_{ij} (\bar{X}_{ij} - \bar{X})^2 - \frac{1}{N(n-1)} \sum_{i=1}^N \sum_{j=1}^n (X_{ij} - \bar{X}_i)^2 \right\} \quad (7)$$

$$\bar{X}_i = \frac{1}{P_i} \sum_{j=1}^n P_{ij} X_{ij} = \frac{1}{P_i} \sum_{j=1}^n Y_{ij} \quad (8)$$

$$\bar{X} = \frac{1}{P} \sum_{i=1}^N P_i \bar{X}_i \quad (9)$$

$$P^* = \frac{1}{Nn-1} \sum_{i=1}^N P_i \left(1 - \frac{P_i}{P}\right) \quad (10)$$

and P_{ij} is the number of extreme losses of the i -th risk in year j .

Data and Applications

Credibility theory is an actuarial approach used to calculate the short term insurance premiums. This approach is used to estimate premiums for each risk based on two ingredients: past data from the risk itself and data collected from other sources.

Data for the Czech insurance market used in this paper are incurred claims from three most important areas and the number of extreme losses from each area for the period from 2006 to 2018. These data are reported from Czech Insurance Association.

In this research we fit a statistical distribution for each risk (i.e. each branch) and estimate the statistical characteristics for each branch. Also we simulate the incurred claims in order to observe the number of extreme losses to apply Bühlmann-Straub credibility to predict the net premium as a linear function of the prior claims and the number of extreme events.

The application of the models that will be used in this paper are carried out by using the R Package (or Statgraphics Centurion) which is an open source environment for mathematical and statistical computations. The actuar package is also used to apply the modified Bühlmann and Bühlmann-Straub credibility models. This section will present the data used in this research and will illustrate the results that are reached by applying the modified credibility models in a different type of risks: such as the natural hazards and the expected net premium that should be collected to cover the extreme losses resulting from occurring of these risks.

Tab. 1: The Amount of Extreme Claims (in thousands CZK)

Damages	2006	2007	2008	2009	2010	2011	2012
Damages caused by weight of snow	2 564 492	20 603	2 403	309 790	1 212 759	271 774	148 399
Damages caused by floods	1 340 848	386 892	5 070	1 508 902	3 994 437	336 827	353 794
Damages caused by gales and hail storms	685 606	3 134 566	1 250 653	1 936 736	2 706 853	1 045 302	1 740 007
Sum	4 590 946	3 542 061	1 258 126	3 755 428	7 914 049	1 653 903	2 242 200
Damages	2013	2014	2015	2016	2017	2018	
Damages caused by weight of snow	124 402	22 070	20 704	19 976	105 474	13 591	
Damages caused by floods	7 457 780	1 013 006	68 245	355 609	170 619	186 373	
Damages caused by gales and hail storms	1 733 727	931 355	1 181 358	1 535 267	2 511 817	1 056 526	
Sum	9 315 909	1 966 431	1 270 307	1 910 852	2 787 910	1 256 490	

Source: own elaboration from (CIA, 2019)

The data of natural hazards is collected as mentioned before from the Czech insurance market and published by the Czech Insurance Association from 2006 to 2018. Table 1 illustrates the number of claims for three main types, they are:

- damage caused by the weight of snow;
- damage caused by the floods;
- damage caused by gales and hail storms.

Table 1 shows the amount of claims in the Czech insurance market. From this table, it is clear that during the period under review, the greatest damage happened in 2013 and it is caused by floods. The Table 2 shows the number of extreme losses for each risk type.

Tab. 2: Number of Extreme Losses

	2006	2007	2008	2009	2010	2011	2012
Damages caused by weight of snow	0	0	0	0	1	0	0
Damages caused by floods	0	0	0	1	1	0	0
Damages caused by gales and hail storms	0	1	1	0	1	0	0
Sum	0	1	1	1	3	0	0
	2013	2014	2015	2016	2017	2018	
Damages caused by weight of snow	0	0	0	0	0	0	
Damages caused by floods	1	0	0	0	0	0	
Damages caused by gales and hail storms	2	0	0	0	0	1	
Sum	3	0	0	0	0	1	

Source: authors' own elaboration, data from (CIA, 2019)

3. Results of the Research

First, a descriptive statistical analysis is conducted to understand the different statistical characteristics of each type of risk that will be analyzed. Table 3 summarizes the statistical characteristics of each risk type.

Tab. 3 summarize the statistical characteristics of each insurance area. Tab. 3 displays the results of amount of claims for the following risk areas: damages caused by wight of snow, damages cased by floods and last risk area was damages caused by gales and hail storms. For damages caused by weight of snow is mean in the amount of 372 034 000 CZK, for damages caused by floods is mean 1 321 420 000 CZK and for damages caused by gales and hail sotrm is the mean 1 649 980 000 CZK.

Tab. 4 summarizes the results obtained from fitting a statistical distribution of each insurance branch and the estimated parameters for each distribution after performing 1000 simulations.

Tab. 3: Descriptive Analysis for Claim Amounts per Risk Area

Risk Area	Mean	Median	St. dev. ¹	Skewness	Kurtosis
Damages caused by weight of snow	372034000	105474000	734193000	3.96215	5.39114
Damages caused by floods	1321420000	355609000	2132260000	3.57881	1.12532
Damages caused by gales and hail storm	1649980000	1535270000	748197000	4.38144	-0.25874

Source: Authors' calculations based on result from Statgraphics Centurion.

Tab. 4: Summary of Parameters Estimated for Each Risk

Risk Area	Distribution	Estimated Parameter	Standard Error
Damages caused by weight of snow	Lognormal	$\mu = 11.25$ $\sigma = 1.882$	0.5220130 0.3691185
Damages caused by floods	Lognormal	$\mu = 12.94$ $\sigma = 1.787$	0.4955488 0.3504054
Damages caused by gales and hail storms	Lognormal	$\mu = 14.22$ $\sigma = 0.4340$	0.12039637 0.08513106

Source: Authors' calculations based on result from R Package

From equations (8) to (10), we obtain the results in Tab. 5. Tab. 5 presents the number of extreme events for each branch of insurance (P_i), also the total amount of claims incurred

per branch (Y_i) in order to calculate the average insured extreme events ($\bar{X}_i$), where

$$P_i = \sum_{j=1}^n P_{ij}, Y_i = \sum_{j=1}^n Y_{ij}.$$

Tab. 5: Computed Characteristics of Branches

Branch	Total number of extremes (P_i)	Total amount of Claims (Y_i)	$\bar{X}_i$
Damages caused by weight of snow	1	4834034	4834034
Damages caused by floods	3	17178402	5726134
Damages caused by gales and hail storms	6	21449773	3574962

Source: Authors' calculations based on result from R Package

As we mentioned before, the projection of the net insurance premium per risk type in 2019 will be reached by applying the same approach of the modified credibility model

¹ St. dev. is standard deviation.

that was used by ElSayed and Soliman (2019). Table 6 shows the calculated credibility factor Z for each type and the projected net premium in each type in 2019.

Tab. 6: Credibility Factors and Estimates of Net Insurance Premiums per risk area in 2019 (in thousands CZK)

Risk area	Credibility factor (Z_i)	Net Insurance Premium
Damages caused by weight of snow	0.7940475	1486558
Damages caused by floods	0.9204231	4178870
Damages caused by gales and hail storm	0.9585628	1961127

Source: Authors' calculations based on result from R Package

Table 6 shows the projected net premiums for each risk type that should be collected in each type by the insurance market in order to be able to cover any extreme events that may occur in 2019. The estimates for net insurance premiums for damages were calculated for the Czech insurance market are: 1 486 558 000 CZK for damages caused by weight of the snow, 4 178 870 000 CZK for damage caused by floods, and finally, 1 961 127 000 CZK for damages caused by gales and hail storm.

4. Discussion

The future development of net premium can be modeled using various statistical modeling tools. Net insurance premiums were estimated using the Bühlmann-Straub Credibility Model.

The following estimates for net insurance premiums for damages were calculated for the Czech insurance market: 1 486 558 000 CZK for damages caused by floods 4 178 870 000 CZK and for damages caused by gales and hail storm 1 961 127 000 CZK.

It is evident that if the insurers used this net premium estimation model, they would be able to create sufficient reserves to cover the risks. Of course, by law, they must make compulsory reserves, which are calculated on the basis of well-defined procedures, whereby insurance companies have to count on maximum damage as well. This model does not calculate as much damage as possible, but the expected net premium is estimated to cover the costs of the insurance company with the appropriate type of risk. This model can serve insurance companies as a complementary model to estimate net premium.

Conclusion

This paper uses the credibility models to project the net premiums with application in natural hazards in Czech Republic. The modified models used are based on the Bühlmann and Bühlmann-Straub credibility models. The actuarial approach that is used in projecting the net premiums is helpful for non life insurance offices that deal with the extreme losses. This is in order to cover its liabilities and keep the office solvent. The models are applied in different types of risks that take place in Czech Republic leading to extreme losses and hence, affecting the Czech insurance market. The results show that the following

estimates for net insurance premiums for damages were calculated for the Czech insurance market: 1 486 558 000 CZK for damages caused by floods 4 178 870 000 CZK and for damages caused by gales and hail storm 1 961 127 000 CZK.

Bühlmann and Bühlmann-Straub credibility approaches represent a recent development of the Bayesian credibility theory; these models apply the greatest accuracy theory. In this study we improved Bühlmann and Bühlmann-Straub credibility models as a joint distribution in order to estimate the net credible premium using incurred claims and extreme losses. However, we adopt Bühlmann-Straub credibility because it doesn't assume that risks are independently and identically distributed (i.i.d). Our research concentrates on three risk areas in the Czech non-life insurance market during the period 2006 to 2018. Furthermore, these branches include extreme events to predict the credibility net premium for the upcoming year 2019 for each branch of insurance in Czech insurance market as shown Tab. 4. Moreover, this process show how much money each branch will need to cover extreme events in order to manage risks.

The future work may include developing the models used and apply different actuarial approaches to predict the net premiums in volatile environments. Also, a comparison between the application of extreme losses and the credibility models between Czech and Egyptian insurance markets can be applied taking into consideration the differences and similarities between the two economies.

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Perception of customer environmental requirements in relation to the product

Abstract

At present, the supply of products and services in developed countries' markets is of high quality and quantity level. Customers are demanding ever higher quality products, their spectrum is constantly increasing, forcing producers to continually innovate products and present them through an appropriate and effective marketing communication mix. As the competitive environment grows significantly and the amount of advertising that is broadcast by the media is growing as well, it causes the marketing messages to be oversaturated. If the company wants to attract the customers, it has to choose something new, unconventional, uninvited, courageous. This is mainly due to significant changes in customers' demands, problematic acquisition of their interest mainly due to the increasing number of competitors, significant shortening of the life cycle of products and, last but not least, the division of markets into micro-segments. Customers are also changing their requirements for products in relation to the environment, so the aim of this paper was to find out what the perception of customer environmental requirements is in relation to the product is. To obtain the results, a questionnaire survey was used that focused on the attributes of quality of mobile phones. The sample consisted of 60 respondents and the results showed that they did not consider the environmental aspect of the selected product to be important. At the same time, however, it turned out that, when pointing to the environmental importance of the product through appropriate marketing communication, their perception changed.

Key Words

Customer requirements, environment, marketing communication, quality.

JEL Classification: L15, M11, M30

Introduction

There is always a link in the form of communication in the relationship between the seller and the buyer. With the growing development of productive forces in the individual stages of human society, changes in the generally binding patterns of behaviour, standards and values, as well as in technological innovation, new forms and means of communication are changing and expanded with new tools (Batra, 2016). These new tools, supported by the development and implementation of information and communication technologies, are increasingly sophisticated and more frequently use the ecological theme to communicate with the customer, which affects all human action activities, from research and development to technical, technological, manufacturing and non-productive, respectively service processes, to fun and relaxation (Killian, 2015), (Paul, 2016).

Businesses take advantage of new opportunities to establish contacts with customers, partners and surroundings. They use not only modern tools of information and communication technologies, but also messages with new content. With this content, with increasing accent, this is the environmental issue that comes into marketing communication, e.g. in the field of energy, industrial product manufacturing, but also in services such as tourism and wholesale and retail (Martínez, 2015). It is a topic not only modern, supporting the competitiveness of organizations, but above all a topic needed. However, not from the point of view of empty phrases, hypocrisy and half-truths, but from the point of view of serious efforts of organizations to improve their environmentally friendly technologies and products step by step (Dangelico, 2017).

Environmental marketing surveys conducted by foreign marketing agencies, e.g. Porter Novelli shows that consumers are becoming more demanding on product quality, where quality no longer stands apart from environmental requirements (Ghosh, 2015). With an increasing number of environmentally sensitive consumers, environmental marketing and organic product markets are becoming more successful. More consumers feel that when they do nothing for the environment, but they do good things by buying environmentally friendly products and have less remorse when they boycott non-organic products. Consumers are five times more interested in what approach the company has, and what specific environmental activities it is doing, as the management of the addressed companies believed. Consumers have confirmed that they are interested in the environmental performance of a given company and they follow it in their consumer behaviour (Shin et al., 2019).

Which entrepreneur would not want to distinguish himself positively from the same or similar products in the consumer market, where a relentless competitive struggle takes place, and engage the customer with something new, exceptional? Such a competitive advantage, which has a strong ecological dimension and will not only be an advertising tool, seems to be the perception of the customer's environmental requirements in relation to the product expressed by the so-called carbon footprint (Diačiková, 2009). A global world with a global marketplace, global customers, global suppliers, and global competitors are changing the way businesses run around the world. The driving force is the product attributes that bring comfort, joy, satisfaction, health and an ecological dimension to customers. The latest challenge is the new Carbon Footprint. Is it just another tool in a relentless competitive market, or is it really about protecting the environment (Diačiková, 2008)?

Carbon footprint

Addressing ecology and climate change issues is a priority for the vast majority of national governments and multinational structures around the world, and it is understandable that interest and demand for carbon footprint information that is directly related to global warming is growing (Zhu, 2016). Our lifestyle, industry, transport, services, agriculture, trade contribute negatively to global warming. Everything we buy, produce and use, contains carbon footprint (Martí, 2015) The carbon footprint of the product or service carries (hence the distinctive name - footprint) the total carbon dioxide (CO₂) and other greenhouse gases that have been emitted during their lifetime from production/generation to recovery. The carbon footprint indicates the total amount of carbon dioxide (CO₂) and other greenhouse gas emissions (methane, nitrous oxide, etc.) associated with

each product lifecycle (raw material extraction, crop production, production, transport, supply chain, use, reuse and end-of-life disposal). These emissions are related, among other things, to electricity generation, heating, transportation and other industrial and agricultural processes. It is a cumulative contribution of the production of companies, their products, services, people, and is expressed in grams of CO₂ that have been emitted into the atmosphere during production and accompanying processes. Many companies strive to achieve low or as low as possible – near zero CO₂ production (Diačiková, 2009). The carbon footprint expresses the full amount of carbon dioxide (CO₂) and other greenhouse gases that are generated throughout the product or service life cycle. It is a cumulative contribution of production of companies, their products, services and people. It is expressed in grams of CO₂, which corresponds to the combined amount of CO₂ and other greenhouse gases produced. Thus, it is CO₂ in grams that has been emitted into the atmosphere during production and accompanying processes. Many companies strive to achieve a low value in CO₂ production, respectively. value close to zero. The Carbon Trust survey in 2006 showed that up to 66% of people would like to know what carbon footprint they left behind in the environment, and 2/3 of consumers want to buy low carbon footprint products (Diačiková, 2008).

UK Trust Company (www.carbontrust.com) has developed a carbon footprint measurement and calculation methodology consisting of five basic steps:

Step 1 – analysis of internal production data - this step details the product, including the necessary raw materials, production processes, waste production, storage, transport to the final product. Analysis needs to be done with all suppliers.

Step 2 – creating a delivery process map - this step describes the entire supply chain from the manufacturer to the market. Includes raw materials, production, distribution, waste management. The supply chain maps the need for each input.

Step 3 – defines boundary conditions and identifies data requirements - defines data limits that are needed. It is unlikely that 100% of all data will be received for the first time. It is enough if they are essential and cover 90% of the data with great certainty.

Step 4 – collecting primary and secondary data - this step collects the actual data needed to calculate the material balance from which the amount of greenhouse gas emissions is calculated. Primary source data is preferred and secondary sources are used when it is not available.

Step 5 – calculating the amount of greenhouse gas emissions - in this step, the material balance of each production node is calculated and converted to the respective amount of greenhouse gas emissions. Emissions are calculated from the amount of energy and direct emission data and are converted by the emission coefficient to pure carbon (Carbon Trust, 2008).

Information and communication technology organizations and carbon footprint

According to ISO 14001 - Environmental Management Systems, many companies worldwide are certified. This standard has been supplemented by ISO 50001 - Energy Management Systems since 2012, which talks about reducing energy costs for organizations (heat, electricity, fuel consumption), which is an effective tool for all types of organizations to effectively manage and change their energy consumption situation (Jabbour, 2015). The first information technology communications company, certified to

ISO 50001 and also certified under the Carbon Trust Standard, is the English company Telefónica UK Limited, known in the Slovak Republic by its subsidiary O2.

In 2010, Telefónica UK were the first in the telecoms sector to be awarded the Carbon Trust Standard for Carbon, recognising their achievements in successfully reducing carbon footprint. Then in 2012, Telefónica UK launched first sustainability plan, the Think Big Blueprint, working with customers, employees, charity and business partners, suppliers and peers to build a more sustainable future. Thanks to this work in delivering these goals, in 2014, O2 became the first telecoms company to achieve triple certification to the Carbon Trust Standard. In 2016 Telefónica UK began the next phase of Think Big Blueprint with a new target to help 20 million people to live better with technology by 2020. This coincided with O2 successfully achieving triple re-certification to the Carbon Trust Standard. The standard is the world's first independent certification for recognising organisations that are measuring, managing and reducing greenhouse gas emissions within their supply chains (Martin, Chouhan, 2017). Significant recent activities include a call from more than 3,500 employees of Amazon. They delivered a call to their boss Jeff Bezos asking him to reduce their carbon footprint and stop supporting fossil fuel miners to whom Amazon provides cloud computing services. It is the most important challenge to date to tackle climate risks in the technology industry. They wrote that Amazon has enough resources, skill and influence to show the world how to tackle the climate crisis urgently. Amazon employees are pushing shareholders to adopt a plan to reduce carbon footprint. Amazon management is working on this challenge and this year will publish the size of its carbon footprint, based on which their measurable environmental actions will be developed and will be controlled by the public (Moniová, 2019).

The authors of the article wanted to verify these facts in the form of a questionnaire survey, which was focused on finding the perception of selected attributes of smartphones quality. An ecological dimension was also included among the attributes monitored, and specific procedures are explained in the Methods of Research chapter.

1.Methods of Research

For example, when a customer chooses foodstuffs in a supermarket, he or she receives - from the data displayed on the packaging - what energy value they have and what is their nutritional composition, i.e. they can evaluate the impact on their health or character. However, they do not know how the production, packaging or transport of the foodstuffs affected environment, respectively ecology. An important question is whether customers want to and need to know it. It is for this reason that the attribute - eco-friendliness - was included in the survey focused on the perception of the quality of mobile phones used, i.e. whether this attribute is also important in customers' requirements. To fulfil the objective, a total of 8 quality attributes - customer requirements were monitored, from which a questionnaire consisting of 5 questions was created. The attributes in question (abbreviated to A) were as follows: **A1**: Fluency **A2**: Battery Life, **A3**: Quality of Photos and Videos, **A4**: Memory, **A5**: Weight, **A6**: Eco-friendliness (production and material), **A7**: Resistance and **A8**: Appearance.

In the first question, the respondents considered the TOTAL SATISFACTION with their mobile phone. The second question found SATISFACTION with their mobile phone in the

listed attributes (A1 to A8), where they expressed their satisfaction numerically on a scale from 0 (very dissatisfied) to 10 (very satisfied). In the third question, which primarily looked at the effectiveness and efficiency of ADVERTISING, it was investigated to what extent the customers were aware of the monitored attributes before buying a mobile phone. The answers were again expressed in numbers on the scale 0 (I didn't know about them at all) up to 10 (I knew it completely). The fourth question monitored IMPORTANCE of the attributes being tracked when they decided to buy a mobile phone. The importance was expressed numerically on a scale of 0 (not important at all) to 10 (very important). Finally, in the fifth question, we looked at whether the respondents would be willing to accept a higher mobile phone PRICE if the quality of the selected attributes improved significantly. They rated their answers on a scale of 0 (I wouldn't accept it at all) after 10 (I wouldn't have a problem with it at all).

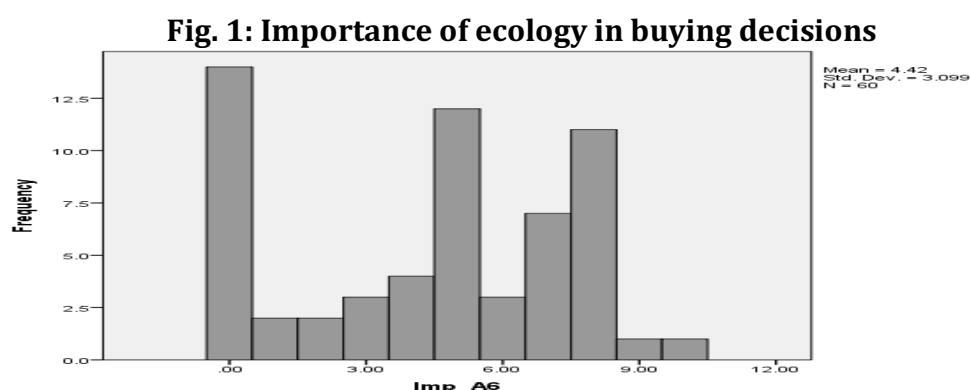
Data obtained from the completed questionnaires were subsequently transferred to spreadsheet environment and the monitored values of individual attributes were calculated separately for each respondent. Subsequently, the data were exported to the SPSS Statistics software, where specific procedures were implemented. The results are presented in graphical form in the Results of the Research chapter.

2. Results of the Research

The sample consisted of 60 valid and completed questionnaires. From these, it was subsequently possible to analyse the subject areas of the analysis. Results from this analysis are found in the following sub-sections.

2.1 The importance of smartphones ecology in buying decisions

As the aim of the survey is to find out the perception of customer environmental requirements in relation to the product, we asked respondents how important the **A6** attribute – eco-friendliness is to them. For better visualization of the data obtained, the data were graphically incorporated into Fig. 1.



Source: authors' own calculations

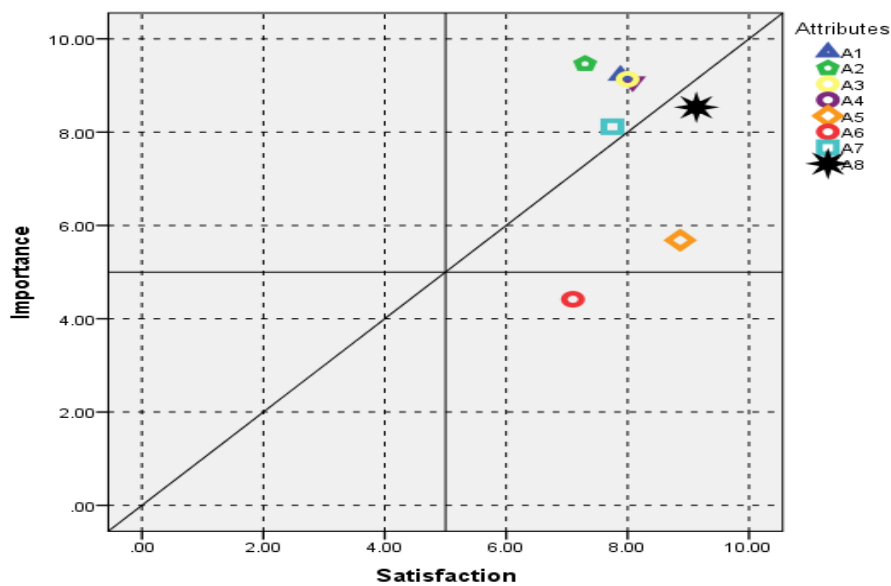
The results in this histogram offer different views. Above all, however, they point out that the large (substantial) part of the respondents does not consider the attribute of ecology

to be important when deciding on buying mobile phones. The remaining part of the respondents considers this attribute important only on average and only a small part considers it important.

2.2 Use of the method Importance performance analysis

For more detailed identification of which of the monitored attributes the respondents consider important and making them satisfied, the data were processed using the IPA (Importance-performance analysis) method. The results are shown in Fig. 2.

Fig. 2: Assessing the importance of selected attributes

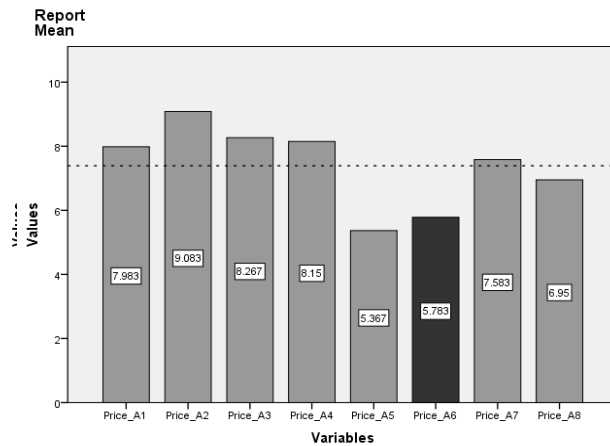


Source: authors' own calculations

Using the IPA method, the data obtained can be divided into 4 quadrants. Ideal, balanced performance occurs when the attributes are as close as possible to the diagonal. The results show that the **A6** attribute is in the "Possible Overkill" quadrant, so it is considered by the respondents to be irrelevant. Other attributes are in the "Keep up the Good Work" quadrant.

A change in the behaviour of respondents in the ecological area was found in a thorough verification of the results. The assumption that the respondents perceived the ecological importance of the selected product only after "impulse" was confirmed by accepting a higher price if the production and material were very ecological. The change of the importance is processed in Fig. 3.

Fig. 3: Comparison of the importance before and after the impulse

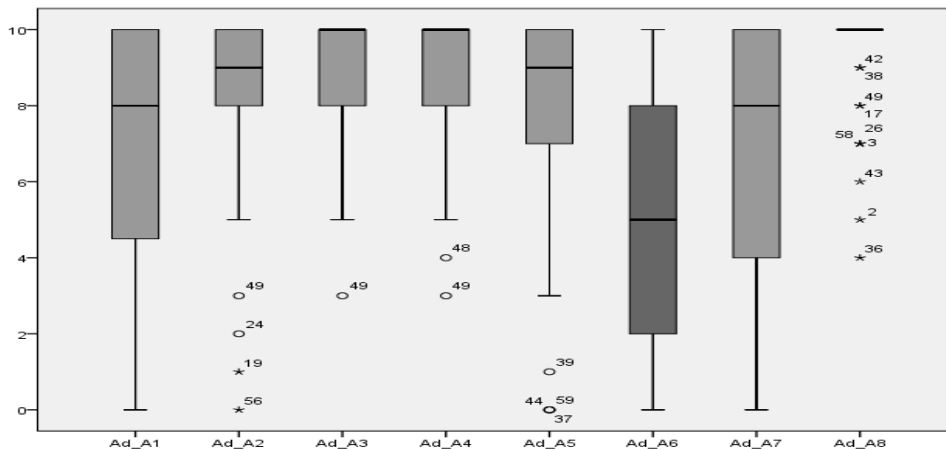


Source: authors' own calculations

2.3 Influence of promotion on selected characteristics of smartphones

The survey was then focused on knowing the attributes of interest in terms of promotion.

Fig. 4: Display of the impact of promotion through boxplot



Source: authors' own calculations

The results show that the mobile phone characteristics were known to the respondents before they bought their mobile phone (A8, A4 and A2). This can be justified by efficient and effective promotion. Again, however, it has been confirmed that companies do not sufficiently promote their environmental impact. Therefore, the optimal marketing communication setting represents a high potential to influence customer requirements and behaviour.

3. Discussion

The competition is high and therefore often to bring the product to the market and attract the customer is mainly combined in an art-positive distinction by original presentation.

Consumer behaviour also affects nature and ecology in a variety of ways, and climate change is often said to cause an increasing amount of greenhouse gases in the atmosphere of production. Therefore, current businesses are looking for alternative sources that emit little or no greenhouse gases while trying to reduce emissions as much as possible. For example, they increase green areas in their surroundings, which absorb carbon oxides, or support the green marketing strategy. By using a wide range of marketing communication tools, businesses can also present their activities to the public - current and potential customers, thereby changing their behaviour. The results obtained include several scientific and practical applications that can be briefly characterized. The results have shown that consumers and mobile phone users are aware of the importance of an ecological area only after being notified, i.e. due to appropriate promotion. This fact is a good place to use appropriate promotion tools, but this only applies if the importance of the requirements is appropriate for the whole group of respondents. The results of this study can be a source of information when deciding how to determine the importance of customer requirements and finding the right communication space.

Conclusion

Due to changing customer requirements in the market environment, scientific and practical quality issues are still up to date. Quality approaches have been adjusted over time, depending on the society current development phase. The presented paper offers a simple view of the perception of selected quality attributes on mobile phones. The behaviour of current consumers is increasingly pointing to the fact that they are also interested in the environmental performance of the business and it influences their consumer behaviour. Consumers' opinions can then be used as input to other marketing activities in businesses.

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Innovation Activities of Foreign Companies Presented in the Liberec Region

Abstract

The aim of this paper is to find out, whether major foreign companies (the largest employers) bring innovation movement, are engaged in innovation activities and show a more significant impact on the development of a regional innovation environment. This issue was investigated based on theoretical research and analysis of available secondary data collected by the Czech Statistical Office in a questionnaire survey dealing with innovation activities under the acronym TI (2018). The complete sample of 31 large foreign companies was selected according to a predetermined criterion (i.e. more than 250 employees, doing business in one of the manufacturing industries and operating in the Liberec Region). Four groups of indicators (identification data, human resources; research, development and innovation; and sales) were monitored. Within HR, the proportion of employees with higher education was considered. Moreover, in the field of R&D and innovation it was investigated whether the companies are engaged in internal / external research (including its spending on the research), whether the company launched an innovative product as well as its intellectual property rights activities. In terms of sales, not only their total amount, but also the share of innovated and non-innovative products were analysed. Based on the analysis of the available data, it was found that a company's approach to innovations varies. Proving a more significant mutual dependence of the scope of innovation activities on individual factors is very problematic and it will be subject to a more detailed research. Nevertheless, some companies show a clear relationship between their R&D activities and their economic results.

Key Words

foreign direct investment, innovation, research & development, spillovers

JEL Classification: O19, O32, O34

Introduction

The theory of internationalisation, based on the so-called step-by-step internationalisation process of companies in terms of their gradual engagement in international trade and international investment activities, has been focused on for many years primarily on the identification of motives which lead companies to undertake internationalisation activities, to verify the impact of internationalisation on the development of these companies and, of course, on confirmation or questioning the relationship between internationalisation and business performance – known as M/P literature (multinationalisation/performance).

Regarding internationalisation motives, Daniels et al. (2015) summarises that all business decisions about whether, where and how the company will engage in international trade are driven by three main objectives:

- to increase sales,
- to acquire resources,
- to lower risks.

However, other authors mention many other more or less related motives concerning e. g. profits, economies of scale, cost distribution, geographical disposition, culture proximity, etc. However, one of the aspects, especially at the beginning of the internationalisation theory development (but also in practice), does not appear very frequently. It is a view, an opinion, a motive of a second party – a space where the expansion of foreign trade and investment caused by internationalising companies is heading. International trade and international investment need their breeding ground – i.e. countries, territories, and states open to internationalisation that allow internationalisation inputs and flow, attract or even welcome them. Without these players, companies would have nowhere to go, nowhere to expand, nowhere to invest.

The openness of economies always has its dual face related to increasing competition and pressure on local companies. Most countries were very foreign direct investment-friendly, since for several years it had been a political spell and a clear argument for creating new jobs in the host country. The expected increase in the employment indicator was also crucial for the granting of investment incentives because according to this indicator, investments were assessed and successful projects which subsequently supported by an investment incentive were selected. Other defined foreign trade functions, transmission and transmission ones, were taken as natural components of the movement, objectively feasible, realised and indisputable.

But what it really caused in specific regions or cities? What benefits, in addition to increasing employment, especially in the area of the middle and less educated human resources, and the influx of others, usually type-identical workers, did investment incentives bring from abroad?

This area is becoming the subject of interest especially recently, when the outflow of massive finances in the form of dividends from local subsidiary companies of large multinational corporations (MNCs) abroad has been criticised and the effect of investment incentives based mainly on the above-mentioned employment has been questioned.

1. Literature Background

Professional publications, which are systematically devoted to assessing the development of companies in terms of benefits for science, research and innovation, the emergence and application of intellectual property rights are not very numerous and the methodology and indicators evaluating these aspects are still inconsistent.

According to Blažek (2019), the objective of countries is not only to attract foreign companies to the host region, but also to use the so-called spill-over effects. These effects are addressed in the study of e.g. Blomström and Kokko (2003) who came to the conclusion that the use of spill-over effects do not automatically take place, but require some degree of technological maturity and skills of the labour force in the host region, so the local companies could absorb them. Already Glass and Saggi (1999) identified the need to invest and develop research and development (R&D) in order to positively benefit from the inflow of foreign direct investment (FDI).

Erdal and Göçer (2015) consider FDI a key factor of competitiveness and an important source of innovation in the host region and are a significant source of not only financial capital, but also technological know-how and managerial skills. Meyborg (2011) highlights the importance of human capital, which is absolutely essential for both technology and knowledge transfer. Last but not least, thanks to the accompanying effects of FDI, the innovative capacity of local companies is stimulated (Sivalogathan and Wu, 2014).

Most of the currently existing studies do not deal exclusively with the impact of FDI on R&D, or the development of innovation activities (innovation climate) in individual regions, but the impact of FDI, or the presence of MNCs on the overall economic development of regions or countries (Alfaro, 2017; Blonningen, 2006; Johnson, 2006), or with regard to key sectors of national economy (Havránek and Iršlová, 2013; 2010).

Given the diverse nature of externalities, quantification of spill-over effects in the field of innovations is difficult (their measurement usually takes place by means of a series of so-called substitutive variables – e.g. R&D expenditure, R&D human resources spending, number of applications for various types of intellectual property rights protection), but Audretsch and Feldman (1995) indicated that industries with potentially greater knowledge spill-over effects (e.g. R&D, high skilled labour) are more prone to innovation activities rather than sectors where knowledge-based externalities are less significant. It makes sense to deal with the issue of the relationship between the absorption capacity of the host regions and the development of innovation activities – evident causalities were confirmed by e.g., Stare and Damijan (2015), Jaklič et al. (2014) or Szent-Ivanyi and Vigvari (2012).

In a European context, e.g. Meyborg (2011) deals with the link between FDI and innovation activities. In her opinion, incoming FDI serves primarily as a source of technology and knowledge transfer through human capital. She concluded that innovation activity is positively affected by the spending on R&D and especially the number of people employed in R&D. The greater importance of human capital compared to R&D expenditures is also confirmed by Korhan et al. (2000) as well as Sivalogathan and Wu (2000). In contrast, Vasthiyampillai and Xiaobo (2014) verified a stronger impact of R&D spending on innovation performance.

2. Methods of Research

In the framework of this research, the innovation activities of FDI were examined on a set of 31 subsidiary companies presented in the Liberec Region, which are based abroad. These are exclusively large companies (with more than 250 employees) operating in a manufacturing industry that are expected to carry out the greatest scope of innovation activities and to have the greatest impact on the innovation climate in the region. More companies did not appear after filtering the CZSO (2018) database according to the selected parameters, so it can be stated that it is a homogeneous group in the complete list. The monitored criteria for individual companies was divided into four areas – Identification; Human Resources (HR); R&D, Innovation; and Turnover.

The analysed sample includes companies based in Germany (10 companies), the United Kingdom (4), Spain (3), Belgium, France, Japan, Canada (2 companies each), Austria, Ireland, the Netherlands, Switzerland, Sweden and the USA (1 company each). In terms of legal form of business, there are 26 limited liability companies, 3 joint stock companies and 2 limited partnerships. In terms of geographical structure, most of the companies operate in the Liberec District (14), followed by the Semily and Česká Lípa Districts (6 companies each) and the least companies are presented in the Jablonec District (5). According to the CZ-NACE classification of economic activities, the largest number of companies (13) within the analysed sample belongs to the group No. 293 - Manufacture of parts and accessories for motor vehicles and their engines.

In the sample of companies, their innovation activities in 2016 were studied. In particular, the performance indicators related to their intellectual property rights protection activities were examined, but some other indicators of innovation activities were also taken into account (number of employees with completed tertiary technical education or higher education, introduction of a new product to the market, share of innovative/non-innovative products on the total sales, whether the company performs its own R&D or buys external research (including costs)).

In the area of intellectual property rights enforcement, seven indicators, which can be considered as the results (consequences) of companies innovation activities, were monitored – whether the company filed a patent application, a utility model application, registered an industrial design or trademark, used the tool of business secrecy (including confidentiality agreements), applied for copyright protection, or acquired a licence to use intellectual property.

3. Results of the Research

Tab. 1 was compiled from the available data resulting from the 2016 Innovation Survey prepared by the Czech Statistical Office (CZSO) under the acronym TI every two years within the Statistical Survey Program. The table provides a general overview of innovation activities performed by the above-mentioned sample of the most important foreign companies doing business in a manufacturing industry in the Liberec Region (sorted in descending order by the average number of employees in 2016).

IDENTIFICATION			HR		R&D, INNOVATION						TURNOVER			
No.	LEGFO	EST	EMP	EMPU (%)	RDIN	RDIN16 (thous. CZK)	RDE	RDEX16 (thous. CZK)	INPRO	NEPR	TURN16 (thous. CZK)	TURNMA (%)	TURIN (%)	TURNO (%)
1	Lp.	1992	3 950	1					0	no	12 281 246			
2	Llc.	2001	2 036	2	yes	3 683	no		0	yes	12 107 650	0.03		0.97
3	Llc.	2000	1 772	3	yes	535 311	yes	3 704	6	yes	8 860 062	0.3		0.7
4	Llc.	1992	1 668	1	yes	2 672	no		1	no	6 174 821			
5	Llc.	1995	1 353	3					0	no	7 617 273			
6	Llc.	2002	1 128	3	yes	250 808	yes	201 096	1	yes	12 234 603	0	0.1	0.9
7	Llc.	2003	1 110	3	yes	43 000	yes	4 200	2	yes	3 218 849	0.1	0.4	0.5
8	Llc.	2002	866	3	yes	10 000	yes	5 000	0	yes	3 576 037	0.8		0.2
9	Jsc.	1994	785	3	yes	29 111	no		0	no	1 564 498			
10	Llc.	1992	756	3	no		no		0	yes	9 951 963	0.25	0.05	0.7
11	Llc.	1994	666	2					0	no	2 395 284			
12	Llc.	2007	633	1	no	0	no		0	yes	2 746 603	0	0.3	0.7
13	Llc.	1992	612	2	no		yes	1 200	2	no	9 825 448			
14	Llc.	1997	546	1					0	no	224 983			
15	Llc.	2015	542	2	no		no		1	no	2 829 204			
16	Llc.	1992	506	3					0	no	2 346 532			
17	Llc.	2001	467	3	yes	29 000	yes	538	0	yes	1 136 119	0.4	0.2	0.4
18	Llc.	2002	451	2	no		no		2	yes	759 610	0.4	0	0.6
19	Jsc.	1992	439	3	yes	1 200	yes	1 300	4	yes	1 816 888	0.1	0.1	0.8
20	Lp.	1999	430	3	no		yes	1 000	1	no	1 161 426			
21	Jsc.	1993	427	3					0	no	1 446 874			
22	Llc.	1993	424	3					0	no	958 023			
23	Llc.	2003	398	3	yes	1 374	yes	77	2	yes	1 827 224	0.05	0.2	0.75
24	Llc.	2000	376	2					1	no	1 247 876			
25	Llc.	1999	366	2					0	no	1 591 468			
26	Llc.	1993	342	3					0	no	1 015 849			
27	Llc.	1988	331	3	yes	15 875	no		0	yes	1 090 909	0.1	0.1	0.8
28	Llc.	1999	310	2	no		no		1	yes	824 413	0.05	0.2	0.75
29	Llc.	1999	298	1					0	no	1 038 073			
30	Llc.	1994	296	3					1	no	1 839 620			
31	Llc.	1995	273	1					0	no	529 810			

Tab. 1: Innovation activities of companies in the Liberec Region (2016)

Source: own construction based on CZSO, 2018

Explanatory notes:

IDENTIFICATION

LEGFO – Legal form of business

Lp. – Limited partnership (komanditní společnost)

Jsc. – Joint-stock company (akcionářská společnost)

Llc. – Limited-liability company (společnost s ručením omezeným)

EST – Year of establishment

HR

EMP – Average number of employees

EMPU – Share of employees with tertiary technical or higher education

R&D, INNOVATION

RDIN – Internal research

RDIN16 – Expenses on internal research

RDE – External research

RDEX16 – Expenses on external research

INPRO – Number of used intellectual property rights protection tools

NEPR – Introduction of new products

TURNOVER

TURN16 – Total turnover

TURNIN – Share of revenues from innovative products in the company

TURNMA – Share of revenues from innovative products in the market

TURNNO – Share of revenues from non-innovated products

Due to the heterogeneous values of indicators among individual companies listed in Tab. 1, it can be stated that it is very difficult to generalise their results to the whole group and to draw general conclusions valid for the monitored substitutive variables and their impact on innovation activities. In addition, only 13 of 31 surveyed companies showed activities in the area of intellectual property rights protection. In order to demonstrate the mutual dependence of the individual indicators, further research would be needed to analyse them in more detail.

Based on the available data it can be said that, for example, the share of employees with completed tertiary technical education or higher education is generally very low (regardless of whether the company is involved in innovation activities or not) – in all analysed companies it ranges from 1 to 3 % and therefore they can be placed into the statistically earmarked group of companies with the values of this indicator ranging from 1 to 4 %. This group includes about 27 % of innovating and 30 % of non-innovating foreign companies operating in the Czech manufacturing industry (CZSO, 2018). While it can be assumed that the more employees with this kind of education the company has, the more people will be employed in R&D and it will be reflected in the introduction of e.g. new products, it is very problematic in this case to demonstrate its more significant impact on the development of innovation activities.

In the group of the largest employers in the Liberec Region, for example, in the case of the company No. 3 in the table, it can be observed that the company is intensively engaged in internal (more than CZK 0.5 billion invested in 2016), but also in external (CZK 3.7 million) research, which is reflected in both the use of intellectual property rights protection tools (this company applied all seven monitored ways of protection) and in the

revenues from innovated products that were completely new in the market (revenues from the innovated products represent 30 % of total revenues). This confirms the authors' belief that investment in R&D supports innovation activities.

The company No. 6 in the table also invests significant financial means in both internal (CZK 251 million) and external (CZK 201 million) research, and in 2016 it also launched new products. However, in this case the products were new only for the company (they already existed in the market). The innovated products accounted for 10 % of total sales. However, in the field of intellectual property rights protection, the company used only one available tool – it acquired a licence to use as an intellectual property subject. However, from the company's point of view, this tool is somewhat specific as it is not used to protect the company's intellectual property rights, but on the contrary, it was purchased to gain the opportunity to use intellectual property rights belonging to another company.

Another example may be the company No. 2 in the table, which invested only in internal research (CZK 3.6 million) and launched some brand-new products, but revenues from these products reached only 3 % of total revenues meaning that most of the revenues stemmed from non-innovative products.

Conclusion

In conclusion, it is possible to compare the findings of several selected empirical surveys that confirm the obvious causality between the size of investment in R&D, the share of skilled labour and the size of spill-over effects in the host region. Based on these surveys, it can be stated that the inflow of FDI into the host region has a positive effect on accelerating R&D and innovation.

Erdal and Göçer (2015), who investigated this issue in the context of ten developing Asian countries, tried to clarify the causes of the very dynamic growth of selected economies (e.g. South Korea, China, Malaysia, Singapore, etc.). In the research they concluded that 1% increase in FDI inflows over the analysed period (1996 – 2014) resulted in an average of 0.83% increase in R&D spending and a 0.42% increase in patent protection applications. However, this dependence can be described as very weak.

A stronger influence of FDI inflows on the number of patent protection applications is demonstrated by Sivalogathan and Wu (2014), who were also investigating this issue in South Asian developing economies. According to their findings, a 1% increase in FDI inflows leads up to 46% increase in patent protection applications. Regarding innovation activities, the authors further emphasise the importance of spending on R&D and education of human capital (however, in these cases without expressing the power of their dependence).

Even though it is quite complicated to generalise the impact of the selected factors on the scope of innovation activities (based on the available data and within the examined set of companies), in the case of some analysed large companies a weaker or stronger dependence of the scope of their innovation activities on their results in the field of innovations was shown, and so it is possible to confirm the conclusions of the above-

mentioned researches, but it is necessary to highlight that those authors were focused on a dynamic development (the relationship between the increase of FDI and the range of innovation activities). However, the strength of this relationship would have to be verified in further research.

Due to the nature of the reported data, which has been analysed in this paper, it is possible to focus on a further comparison of not only individual regions of the Czech Republic, but also between individual EU countries (the CZSO takes over the questions from the Eurostat questionnaire).

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Willingness to start up a business and the social capital in a regional context

Abstract

The paper is focused on the connection between the willingness to do business and individual capital in the context of the Ústí Region as an example of a disadvantaged region. Social capital is divided into bonding capital, related with family and friendship relations, and mobilizing capital, related to the instrumental solution of situations with the help of social relations. The paper has used a secondary analysis of data gained thanks to a questionnaire survey, which was representative of inhabitants of the Ústí Region. The results showed that the willingness to do business was connected with mobilizing social capital, while bonding social capital did not play any role. The analysis, however, also includes other variables as the role of the social capital differs, for instance, regionally: people with a higher education are more willing to do business, and the same also applies to people declaring a willingness to leave the region. The complex of variables related to the low level of willingness to do business cannot be reduced to mobilizing social capital. However, it is also necessary to reflect its significant role.

Key Words

entrepreneurship, self employment, mobilizing social capital, bonding social capital, regional diversification

JEL Classification: L26, Z13

Introduction

The following paper will focus on connections between the willingness to do business, the social capital of inhabitants of the Ústí Region and other factors that could influence the decision to do business in the region, which can be the economically disadvantaged market in the framework of the Czech Republic.

In terms of theory, social capital can be divided into social and individual capital. The social approach sees social capital as characteristics of a social organisation including its trustworthiness, reciprocity, norms and networks. They contribute to better efficiency of the operation of society and simplify the coordination of joint activities (Putman, 2001). Individual social capital is a personal source for an individual embedded in their social networks, which can be activated through relations in networks (Lin, 2002). These relations are activated primarily in situations when an individual feels a need to get information or strive for a shift on a social scale. This means that social capital is a competitive advantage when fulfilling personal goals. (Coleman, 1988). The individual social capital can be further divided into bonding, or interaction, capital (available social

sources) and mobilisation capital, i. e. the “mobilisation” of the sources, where the first type is a constitutional part of both the individual and the social capital (Šafr & Sedláčková, 2006).

The term “social capital” was originally a sociologic term used to describe aspects of social stratification. However, now it is used in all social sciences. In terms of economic literature, social capital as a topic was introduced by Becker (1997). He considers it one part of human capital; it experiences amortisation, and its effects show a characteristic of an externality (Becker, 1997). The influence of individual social capital on an improvement in (economic) power is also researched (Foley & O'Connor, 2013), as well as the access to tangible and intangible resources and the multiplicative effects of social capital on business (Debrulle, Maes, & Sels, 2014). In the framework of economic discourse, it is possible to see social capital in view of know-how distribution with a focus on the information asymmetry and related opportunities for businessmen, where the main barrier for a successful appreciation of social capital and related know-how lies in distribution channels, which can be eliminated by building a diversified portfolio of social relations (Klyver, Evald, & Hindle, 2011). In economy, social capital is approached also as a tool reducing transaction costs (Estrin, Mickiewicz, & Stephan, 2013) and making it possible to resolve problems, contributing to the reduction of risks and simplifying the decision-making process (Bowey & Easton, 2007).

Despite a proliferation of approaches to social capital in economic theory, the authors agree on the basic determination of the term as an investment in social relations with an expectation of future market revenues. Questionnaires or experiments, such as Putman's social capital index (Putman, 2001), summation index ISC, generators of names and positions, and more, are usually used to measure the individual social capital.

However, professional papers also describe other determinants for business activities. The most frequent ones include the unemployment rate (Apergis & Payne, 2016), the business cycle (Scholman, van Stel, & Thurik, 2015), the interest rate development (Chowdhury, Desai, & Audretsch, 2018), or combinations of some of the above-mentioned factors. Foreign direct investments and the business environment described, for instance, by the economic freedom index or the number of administrative operations necessary for the establishment of a business also play an important role in starting a business. The further growth of a company is significantly influenced by circumstances of its establishment, i.e. if it was established due to need (in a situation when employment was not an option) or due to an identified opportunity, where the latter is a stimulus for greater expansion (Dvouletý, 2018), (Farlie & Fossen, 2018).

When researching the influence of social capital on the willingness to do business, it is necessary to also reflect the factors that could have influence on the regional level, i.e. the rate of unemployment, the volume of foreign direct investments and the share of people already doing business. The Ústí Region is the fifth most populated region in the Czech Republic, thanks to the total number of 820,789 inhabitants. The unemployment rate is among the highest, currently at 4.7% (the national average reaches 2%) and there is 1.8 applicants per one available job. It is characteristic for the Ústí Region that people frequently move to Prague and the Central Bohemia Region. There is also a higher rate of internal migration activity in the region due to the geographic settlement patterns. However, the overall migration balance was positive in the last two years as it was

improved thanks to the positive foreign balance of migration. The number of inhabitants, however, decreases due to the negative population growth (CZSO, 2018).

The foreign direct investment is only very loosely integrated in the Ústí Region's economy, as only 2.4% is allocated for the Ústí Region. This also impacts the slow rate of upgrading current production capacities. The register of economic entities for the Ústí region showed 176,111 entities as of the end of last year. This figure included 139,325 self-employed people. This was a below-average value compared to the national average. The share of self-employed people of the total number of economically active people reached only slightly below-average values within the Czech Republic. Only nearly 50% of the registered people really execute activities as self-employed persons (Bisnode, 2017), and the number of active entrepreneurs has been gradually decreasing since 2013. Compared to the current period, the number of entrepreneurs was 6.5 percentage points up in the years 2009 - 2012. The educational structure in the region does not reach the average for the Czech Republic, and primarily, the share of people with a university degree lags behind the national average by 7 percentage points (the year 2017). In terms of business in the Czech Republic, men show a significantly higher share compared to women, and there are two male entrepreneurs per one female. This proportion is more favourable for women in the Ústí Region (CZSO, 2018).

1. Methods of Research

The goal of the research is to identify the role of individual social capital in relation to the willingness to do business and uncover relations tied to the decision either to do business or to consider business activities. With regard to the character of required results, the authors used the possibility of a secondary analysis of data received in the framework of the survey Development Potential of the Ústí Region executed on a sample of 1,362 respondents. It was a quota sampling among inhabitants of the Ústí Region aged 20 – 70 years. The sample is representative, and it is thus possible to generalise the results of the questionnaire survey to all inhabitants of the Ústí Region. The data was collected in March and April 2018 with the help of a network of inquirers and a non-standardised questionnaire. The questionnaire was of an omnibus survey nature. However, only questions focused on the willingness to do business and the dimensions of the individual social capital were intentionally chosen for the purpose of researching the influence of the social capital on business.

The individual social capital in this research was operationalized on two levels – its bonding form as relations to family and friends and faith in help from them and the mobilisation form as instrumental possibilities of help in important situations.

The data was processed with the software SPSS. The authors used exploratory factor analysis and then created summation indices and used multinomial logistic regression.

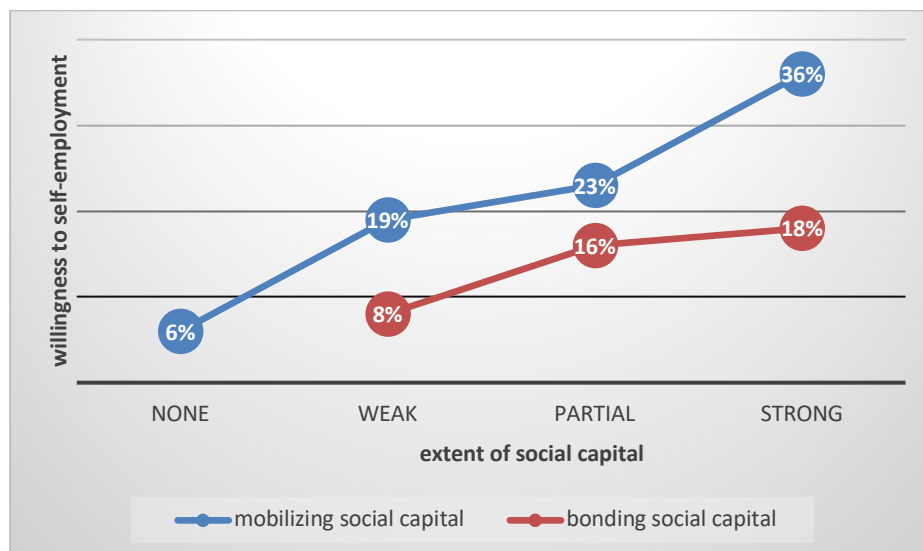
2. Results of the Research

To be able to deal with the problem of the willingness to do business in the context of social capital and other variables, it is necessary to mention how business activity or the consideration of being involved in some kind of business is distributed across the population. More than two thirds of people (68%) completely reject the idea. Some 8% of respondents actually do or did business, and 9% of respondents have admitted considerations about doing business (categories *I seriously considered that* and *Sometimes I think that* were merged). A total of 15% of respondents have chosen the answer *It came to my mind, however, I have not considered it seriously*.

Social capital, measured as a rate of consent with statements characterising particular shapes of social relations and networks, after the factor analysis application really confirmed the logic of the division to two kinds of social capital. The first factor is formed by parts connected with the instrumental involvement of social relations when solving different life situations and problems. It represents mobilizing social capital. The second factor connects parts of the bonding part of the social capital (relations among relatives and friends).

Summation indices were used in the framework of particular factors (the suitability of their use was verified by Cronbach's alpha), and mobilizing social capital was divided into strong ("I have always or nearly always someone to turn to"), medium, weak, or none ("I have no one to turn to in the given situation"). The bonding family capital reached different values in absolute figures, and all respondents have shown at least some, so the authors used a different labelling – above average, average, and below-average.

Fig. 1: Willingness to do business depending on social capital

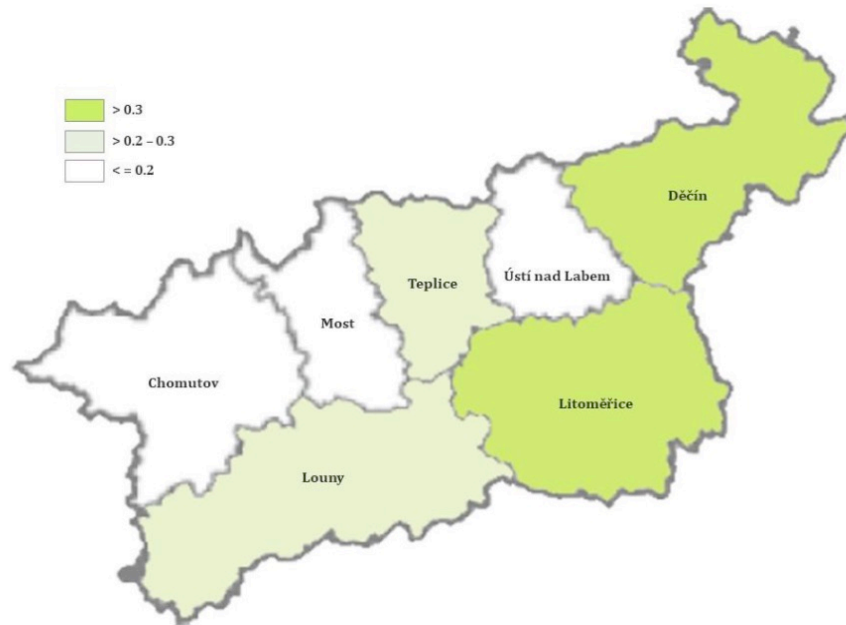


Source: authors' own calculations

Such adjusted social capital was put in relation with the willingness to do business or to consider it, as monitored in the questionnaire. When involving particular parts or both factors, the influence of the bonding social capital was insignificant. However, it was

possible to see a statistically significant (p -value 0.00) relation with the mobilizing capital. Figure no. 1 shows that the higher the value of the mobilisation social capital is, the more frequently respondents are willing to consider doing business. The value of the correlation coefficient reaches 0.2, i.e. a medium strength of relation.

Fig. 2: Relation of the mobilizing social capital with the willingness to do business in particular districts of the Ústí Region (value of correlation coefficient)



Source: authors' own calculations

The survey also showed that the influence of the mobilizing social capital on the willingness to do business was different in particular districts (see figure no. 2). The correlation shows the highest figures in the districts of Litoměřice and Děčín, where the Kendall's tau coefficient exceeds 0.3, so the correlation is medium high. Each of the districts has a different character of infrastructure. The district of Litoměřice is close to Prague and shows a high development potential, while the district of Děčín has a character of social and regional exclusion (poor infrastructure, low population density). Mobilizing social capital has different roles. It is rather a necessity and expression of a higher level of control over one's economic situation in the case of the district of Děčín, while, in the district of Litoměřice, it is rather about the perception of a competitive advantage related to the geographic proximity of the economic centre. On the other hand, it is apparent that there is practically no individual social capital in districts characterised by large industrial enterprises and opportunities for employees, such as Ústí nad Labem, Most and Chomutov. People decided to do business based on different factors there (Kendall's tau coefficient at 0.1).

Additional variables influence the process of making decisions about doing business. A statistical significance (p -value 0.00) was, for instance, registered for the relation with considerations about moving out of the region, which could be a statement about

flexibility and also personal dissatisfaction with the situation in the region by respondents mentioning a higher willingness to do business.

A multinomial logistic regression was processed in relation to considerations about what other influences enter into the process of making decision about doing business. It included, as independent variables, not only social capital, but also gender, level of education, involvement in the local politics, size of municipality and region. This also proved that bonding social capital does not relate to making decisions about doing business nor to the size of a municipality. Neither involvement in local politics nor the gender of respondents have proven a relation with the willingness to do business, even though in terms of already active entrepreneurs, the share of male and female entrepreneurs is significantly uneven with a significant dominance of men. The category of education plays its role; more educated people, who show also a higher mobilizing social capital, consider doing business more often. In the case of the mobilizing social capital, it was necessary to adjust the effect of the category *I already do or did business* first, as the mobilizing social capital can be either the cause or the result of the activity. However, it is possible to find a higher rate of social capital also among those rejecting the idea, so it is possible to talk about a correlation.

3. Discussion

All executed statistical analyses very convincingly prove the fact that social capital is divided into two completely independent parts in the case of the willingness to do business. They are bonding social capital, whose influence can be completely ignored in this regard, and mobilizing social capital, which is, on the other hand, very important in the process of decision-making concerning business activities. This can be interpreted as the main influence of the activity of individuals, contrary to their social status determined by their origin. The role of mobilizing capital can be different, as it is shown, for instance, by the regional diversification, however, it is without doubt that “useful acquaintances” in different fields of life are something that unquestionably strengthen the willingness to do business.

A higher willingness to do business in the district of Děčín provides evidence of a relation with factors other than social capital. The greater willingness to do business in the district of Děčín is caused rather by structural causes related with the region than by the rate of social capital. The results also indicate that a low level of willingness to do business is also influenced by the current favourable situation in the labour market. Even though the unemployment rate in the Ústí Region is more than two times higher than the national average, it is still at its long-term low. Business is thus perceived as an alternative to a more preferred employment, and people are not as interested in self-employment in the environment of a higher offer of employment opportunities. This also explains the fact of why many business entities do not grow, because business caused by “need” does not have such growth potential, contrary to the use of opportunities on the market, as it also has been proven by other papers (Dvouletý, 2018).

The fact that doing business is most often considered by those thinking about leaving the region can be interpreted on two levels. It can be either individual potential including flexibility, a will for a change on any level of life, or maybe the dissatisfaction with the

conditions of life in the region, which is more visible in more self-confident and independent respondents. Or it can be outer, socio-economic, factors, i.e. that conditions for business in the region are not considered favourable (for instance due to lower foreign direct investments), or do not reflect the change of the business environment, whose relation with a particular locality decreases and makes geographic flexibility possible for entrepreneurs (for instance in relation with the development of online business).

Conclusion

Even though the business segment has an important position in the Ústí Region, its role could be rather weaker in the future. There is no motivation for business activities in the situation where economic growth is followed by decreasing unemployment. It is possible to expect higher interest in doing business if the situation changes. However, the growth will be low. The remaining newly emerging enterprises based on ideas and developed social relations are threatened by a possible relocation to some other region of the Czech Republic. This could make worse the already unfavourable trend of departures of the educated population (brain drain), the level of which is currently significantly lower compared to other regions. A lower level of attractiveness of the region for foreign direct investments is a factor making the business activity weaker. The question is: Will the Ústí Region be able to find a way to make conditions for businessmen attractive enough to prevent further outflow of economically active and self-supporting inhabitants?

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A Systems Engineering -Inspired Method for Studying Entrepreneurship Programs

Abstract

Entrepreneurship has gained increasing attention in higher-education. Outshoot of this interest are entrepreneurship programs, which train and fund nascent entrepreneurs with university background. These programs utilize a plethora of well studied innovation and entrepreneurship tools. What is not well understood, however, is how we should factor in the unique motivations and needs of the entrepreneurs themselves. The current entrepreneurial motivation research has the problem of being too abstract to be practically useful for program managers. In this paper, we hope to find a new research methodology and as a result claim to have found one in object-process methodology (OPM). We demonstrate the applicability of the methodology by using it to model a Finnish university-funded micro-funding program targeting students and researchers with new innovative business ideas.

Key Words

entrepreneurship, entrepreneurship programs, object-process methodology, entrepreneurial motivation

JEL Classification: C21, R13

Introduction

There exists a lot of research about and methods for nascent entrepreneurs and organizations involved in the process of developing new business opportunities. Bulk of these methods have focused on the questions of business viability and uncertainty reduction. Methods like the discovery-driven planning by McGrath and MacMillan (1995), the lean startup by Eric Ries (2011), the DEFT by Innosight's Scott Anthony (2014) are focused on testing and validating business ideas efficiently. Business model canvas generation by Alexander Osterwalder (2008) is a widely popular tool in entrepreneur programs worldwide with a focus on modelling and innovating at the level of the whole business model. More approaches include Outcome-Driven Innovation by Strategyn's Anthony Ullwick (2005) and the Jobs-to-be-Done theory by Clayton Christensen et al. (2016), which focus on recognizing and understating the customer needs deeply before putting actual effort in developing and implementing any business ideas based on them.

Another set of tools and thinking utilized in many programs is the design thinking approach made famous during the 90s by design company IDEO (Camacho, 2016). Like more evolved versions of the same thinking, design thinking emphasizes understanding the customer's perspective by careful observation and interviews. Von Hippel's lead-user theory (1986) is based on the idea that knowledge of customer needs is best captured by customers themselves. Lead users are users of the product, and they use the product in

more demanding context so that they have unique intuition about the direction the product should evolve next.

Outshoot of the customer centric thinking are the user-driven innovation practices, which seek to involve all types of users, not just lead users, and other stakeholder as active participants in the innovation process (Melkas & Harmaakorpi, 2011). However, these workshop-based methods are rarely utilized in entrepreneurship programs, probably due to considerably time and effort required in implementing them.

All of the above innovation methodologies and approaches implicitly assume that the entrepreneur or the innovating organization has the motivation and (limited) resources to implement what ever the methodology suggests. By letting go of this assumption we have to factor in the entrepreneur and his/her motivation to develop a business. This is important, because all innovation processes fail, if there's nobody implementing it.

In order to design better entrepreneurship programs, we need to have a crisp understanding what the customers of those programs i.e. entrepreneurs, or soon-to-be entrepreneurs, are actually trying to achieve and what motivates them.

In their review of entrepreneurial motivation research, Carsrud and Brännback (2011) say that the topic had not been studied much in for over two decades. They explain how research on this topic started initially by borrowing heavily on other social disciplines, but for example trait theorists failed to find actual entrepreneur-traits. In their review, Carsrud and Brännback recognize two main types of motivation theories: drive theories and incentive theories. The first one has psychological origins seeing a person animated because of need to release tension generated by internal tension. The second type look at motivation through the lens of economic theory and see it as something generate via the "pull" of external goals. This research is more in line with the latter type of research tradition.

Temporal Motivation Theory by Steel and König (2006) is one of the emerging theories that combines several former psychological and economic motivational theories. They write that "TMT indicates that motivation can be understood by the effects of expectancy and value, weakened by delay, with differences for rewards and losses." From our point of view the key unknown in terms of entrepreneurship as a choice in here is the question of value: what is the value a person is hoping to gain when starting on the entrepreneurial path?

From Carsrud and Brännback we get some indication on the types of value entrepreneurs gain. They list four major categories of entrepreneurial motivation: economically motivated entrepreneur, socially motivated entrepreneur, lifestyle entrepreneur and artist or craftsmen. According to this classification only the economically motivated entrepreneur is interested in maximizing economic gains. For all others economic gains motivate only to some extent, other outcomes need to be factored in.

From our point of view, the current research on entrepreneurial motivation has suffered from issue of staying at a too abstract level resisting the move to context specific analysis (Carsrud and Brännback, 2011). For people running entrepreneurship programs a more complete understanding of people's motivations is crucial. From a design perspective, the

customer's need should be understood much better in order to develop a product or solution answering that need. The question is: how should we study that need, what tools should we use utilize?

1. Methods of Research

We want to discover a set of tools that is loosely based on a customer need centric framework of Jobs-To-Be-Done by Clayton Christensen et al. (2016) and is aligned with Temporal Motivation Theory of Steel and König (2006). To differentiate ourselves from Christensen's approach, we are especially interested in implementing highly formal and specific approaches, perhaps similar to works of Ullwick (2006). Ideally, these approaches would focus solely on developing products and processes that satisfy customer needs i.e. customer requirements, and taking in to account contextual factors and other requirements from all the stakeholders involved.

The aim is to find a suitable methodology and then illustrate its applicability on an entrepreneurship program. The methodology should allow us to recognize patterns and similarities in different programs and individual journeys by harmonizing how they are expressed and modelled. Also, the methodology should allow the modeller to verify if he or she has understood the stakeholders perspective correctly.

The applicability will be demonstrated targeting a Finnish university-operated micro-funding program. One of these micro-funding programs is the Draft Program® (Karelia University of Applied Sciences, 2019), which grants micro-funding to teams of students and faculty members developing new innovative business ideas and who are coming from two different cities in Eastern Finland: Joensuu and Kuopio. From Joensuu participating educational institutions are Karelia University of Applied Sciences, University of Eastern Finland and Riveria Vocational College. From Kuopio the organisations are Savonia University of Applied Sciences, University of Eastern Finland and SAKKY Vocational College. These programs have open calls every four months, granting funding each time up to 8 new applicant teams and 4 older teams. Programs in both locations operate to somewhat independently of each other.

Draft Program was originally a technology transfer project under national TULI program. This early version from 2008 – 2011 focused on looking innovative business ideas from student population and university employees, and then paying outside consultants for services such as novelty search, patentability evaluations and business potential estimations. This early version of the program was not seen as very effective (Helin, 2012), and eventually the program's implementation at Karelia UAS evolved and re-launched with it's current name in 2012. The program also started to have more emphasis on teams instead of lone inventors and helping teams to build and test their ideas, or some parts of it. In other words the program became more of a proof-of-concept program or a micro funding program.

Similar programs or competitions exists in other cities in Finland including Kuopio, Lappeenranta, Kotka, Mikkeli, Hämeenlinna, Helsinki and Jyväskylä. Key shared feature of these programs is the fact that they grant micro funding that can range from few hundred

euros to few thousands euros. Also, they all tend to emphasize innovativeness of the business ideas and teams at expense of lone inventors. Some have bigger focus on students, but some also grant funding to employees.

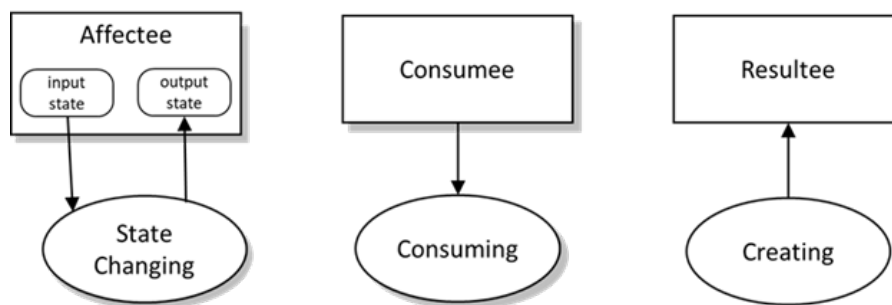
We feel that micro-funding programs and their „customers“, i.e. participants, offer an excellent opportunity to study entrepreneurship and offer an opportunity to discover better and more efficient entrepreneurship services.

2. Results of the Research

Object-Process Methodology (OPM) was recently (ISO, 2015) adopted as ISO 19450 standard. OPM is a conceptual modelling language, which allows organized research and design of complex systems. OPM is founded on minimal universal ontology. This ontology states that the world consists of only objects, processes and relations between them. Further, object can be physical or informatical and together they represent the things that exist.

Processes on the other hand are not detected directly, but through how they transform objects. Three fundamental transformations that are (1) creation, (2) consumption and (3) change in the state of an object. Figure 1 shows the basic symbols of objects (rectangle) and processes (ellipses) and their relations (connecting links). A gray shadow signifies that a process or object is physical, while shadowless rectangle or ellipse signifies that the object or process is informatical.

Fig. 1: Basic symbols of OPM.

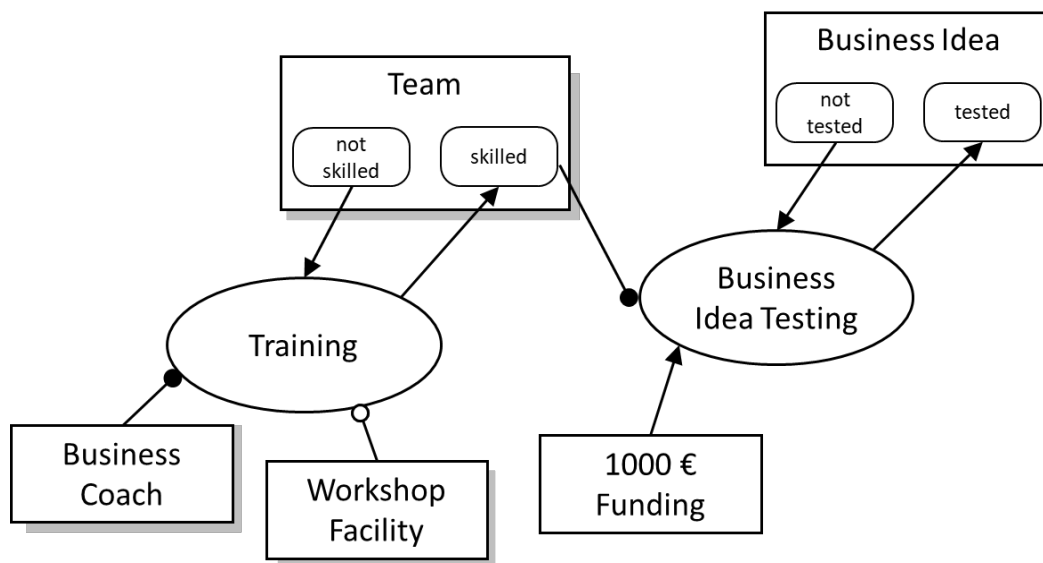


Key aspect of OPM is that it is a dualistic modelling language in the sense that all visual diagrams have text-based counterpart in a way that each one of them can be re-produced based on the other counterpart. This feature makes modelling various types of phenomena from technological systems to natural and social systems (Dori, 2016) simple. For example, customer need or the value customer expects to gain from a service or product can be defined using one the three fundamental transformation. The value a weight-loss program delivers could be expressed as a lowering (a process) of the bodyweight (a state) of a person (physical object), which will lead to improving (a process) looks (a state) and improving (a process) health (a state).

Next we will test the applicability of OPM by using it to model an existing entrepreneurship program i.e. the Draft Program®.

Application of OPM means that through careful observation we aim to recognize the relevant objects and processes and their relations. For example the defining (a process) of a business model (an object) is process that produces a document, but it's main effect is likely best captured as how it changes how the entrepreneur (an object) understands the goodness (a state) of the business idea (an object). In figure 2 we present a high-level model of the Draft Program® using OPM. The model is based on the information publicly available on the Program's website (Karelia University of Applied Sciences, 2019).

Fig 2: OPM Diagram of the Draft Program®



Arrows with rounded ends in Figure 2 symbolize instruments (white circle point) needed in the proces and agents initiating (dark circle point) the proces.

3. Discussion

Object-Process Methodology presented above seems like a promising tool in the study of entrepreneurship programs. The model presented in figure 2 captures some of the core outcomes and processes of one such a program. Importantly the model clearly differentiates different things and their relationships.

Next step would be zooming deeper in to the processes of Training and Business Idea Testing so that their internal structure could be decomposed in detail. Further, the applicability of OPM could be tested in other programs. Resulting models could then be validated by collecting feedback from the program stakeholders.

Conclusion

In this paper we presented the field of entrepreneurship programs in higher education. We argued that studying the motivations and needs of the nascent entrepreneurs taking part to these program is highly important. Also, we stated that psychological theories of motivations tend to float at too abstract level, giving limited tools for programs managers to improve their offering.

To solve this problem, we wrote that it is important to find a methodology that makes it possible to study the contextual factors of entrepreneurship in such a way that it opens doors for design improvements of Entrepreneurship programs. As a solution we presented the Object-Process Methodology (OPM), a systems engineering modelling language, with origins in the technical fields such as the aerospace industry. To demonstrate the usefulness of the language we illustrated how the language can model different types of systems. In this case, we did a simple high-level model of a Finnish university-run micro-funding program.

OPM is a promising new toolset that has the potential further entrepreneurship research. Larger and more in depth studies on it's applicability are needed.

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Conceptual System of Principles Classification and its Application by Management Systems of Modern Organizations at Various Phases of their Life Cycle

Abstract

This article classifies concept regulations for the improvement of various business associations management systems. Our research purpose is to develop theoretical regulations and methodological recommendations for managerial approaches to the solution of problems concerning the business associations management systems efficiency improvement within hyper-competitive material-virtual business environment. It is obtained by the number of considered driving forces of hypercompetition for their success factors. The authors propose to decompose the conceptual system of principles into one class and four subclasses of principles for the work convenience in the considered business associations practice of managers. Management systems should use appropriate subclass of principles together with the class of principles according to the corresponding hypercompetition driving force. It deals with an approach of using this classification in relation to the main life cycle phases of the construction sphere business associations management systems in terms of a market economy hypercompetitive material-virtual business environment. This approach is designed to develop appropriate methodological support for improving management systems of business associations with the use of information-communication technologies and managementology at all their life cycle phases in a hypercompetitive material-virtual business environment of the market economy.

Key Words

management system principles conceptual system, classification, life cycle, managementology.

JEL Classification: D01, D81, P13, Y2

Introduction

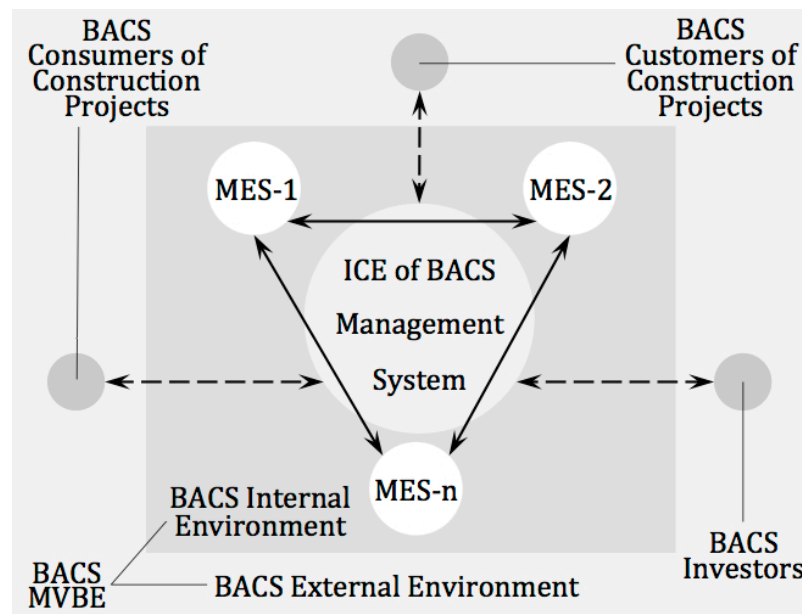
In the conditions of rapid changes within the modern material-virtual business environment (MVBE), the transition to a new technological way of life is characterized by the widespread application of information-communication technologies (ICT) (Kunyaev, Martynov, 2019). They are necessary to solve not only technical and technological but also socio-economical and managerial problems arising during the construction of new and

improvement of existing industrial facilities. Various business associations of the construction sphere (BACS) (Kunyaev, Martynov, 2017b, 2018a, 2019) carrying that out are generally depicted in Fig. 1.

The activity of these modern organizations (enterprises, holdings, alliances, etc.) is the basis for the material production branches (Grabovoy, 2018). They implement the construction of unique permanent industry facilities and renewal of existing ones designed for the production of high-tech products in conditions of hypercompetitive MVBE (Kunyaev, Martynov, 2019).

Competent use of ICT within such business associations actualizes the solution of the problem concerning management systems improvement at various phases of their life cycle in a new competitive environment.

Fig. 1. Business association of the construction sphere within the material-virtual business environment.



Source: Authors Plotting

1. The research problem statement

Our research purpose is to develop theoretical regulations and methodological recommendations for managerial approaches to the solution of problems concerning the business associations management systems efficiency improvement within hypercompetitive MVBE. Results of our research (e.g., Kunyaev, Martynov, 2019) show that BACS should:

First, master a virtual component of the modern business environment using ICT in the formation and development of a network for targeted interactions between business

partners - managing enterprise structures (MES). Such environment we call information-communication environment (ICE);

Secondly, competently transform intellectual resources for personnel and MES management extracting genuine data on the dynamics of the ongoing socio-economical and other processes within the modern MVBE. This transformation of the considered management system depends on the information-communication environment development of mentioned above interactions, and the competent use of ICT by its staff in the conditions of ICE;

Third, use appropriate management, such as information-communication management (ICM) (Martynov, 2007). It allows solving many problems providing proper personnel management using ICT to implement indirect communications in the ICE conditions. Therefore, ICM is a management innovation designed to improve the effective use of associations business activity in the modern business environment. At the same time, the ICM may include either application of other management types or varieties of ICM itself due to its rapid development (Martynov, 2010);

Fourth, use the developed author's conceptual system of principles (Kunyaev, Martynov, Starozhuk, 2017a, 2018b, 2018c, 2018d, 2018e, 2018f) to ensure proper functioning and development of BACS in the new competitive environment. Its interrelated elements are the basis for our concept and reflect the influence of five hypercompetition driving forces, considering their most relevant features, on the BACS management system success factors (Kunyaev, Martynov, 2017b).

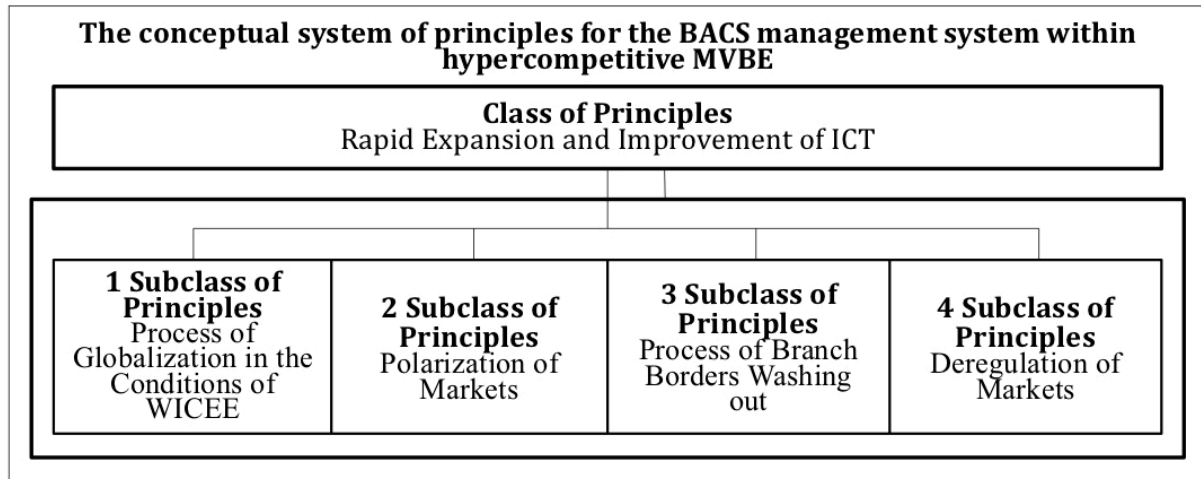
Thus, this paper considers the decomposition of the fundamental regulations – the conceptual system of principles. We are talking about classification system components which were obtained in works (Kunyaev, Martynov, Starozhuk, 2018b, 2018c, 2018d, 2018e, 2018f) and tested in (Kunyaev, Martynov, 2017b, 2018g). Moreover, this paper presents the approach to the authors classification application in relation to the concept of the organization life cycle (OLC) (Hanks, 1990) in the conditions of hypercompetitive MVBE.

2. Decomposing of the principles conceptual system

To solve the first problem, we will use the natural dialectical method of reality cognition – classification, which is a universal form of knowledge systematization. This method was fully regarded in many works (e.g., Meyen, Shreider, 1976; Omelchenko, 2008). Classification theory basic regulations have been thoroughly disclosed in these works. Scientific achievements of the reality cognition systemology fundamentals presented in them, the ways and mechanisms of the classification process formalization allow us to use the appropriate problem statement model and its solutions.

Therefore, as it is shown in Fig. 2, it is possible to present our conceptual system of principles according to the number of considered hypercompetition driving forces (e.g. (Kunyaev, Martynov, 2017a, 2017b, 2019) as one class and four subclasses of principles.

Fig 2. Classification model of conceptual system of principles for the construction sphere business associations management system within hypercompetitive material-virtual business environment considering “hypercompetition driving forces influence relevance on the BACS management system success factors”



Source: Authors Plotting

The class of principles will reflect impact aspects of the rapid diffusion and improvement of ICTs on the BACS management system. It can be characterized as a General class of principles, as today almost any activity is related to the use of ICT in a virtual environment (Kunyaev, Martynov, Starozhuk, 2018f). In this case, management personnel should determine the utilization factor of ICE with ICT within the MVBE. It is important when coordinating the interests of geographically distant from each other BACS business process participants. Adaptation of the considering control system can be based on the BACS investment activity appropriate assessment.

The 1st subclass of principles will reflect globalization process aspects in the context of the formation of the world information-communication economic environment (WICEE), which usually determines the information comparability and availability. This subclass will be characterized by us as Special since the innovations implementation by the BACS management system to create values today is carried out via free dissemination of information, knowledge, technology, and capital through space and time assimilating ICE using latest ICT (Kunyaev, Martynov, Starozhuk, 2018b).

The 2nd subclass of principles will reflect markets polarization process and employees skills polarization aspects which depend on scientific and technological progress (STP). This subclass can be characterized as Special due to the increasingly high production and business processes automation in terms of General computerization. It also influences medium-skilled personnel replacement in the direction of low or high qualification (Kunyaev, Martynov, Starozhuk, 2018c).

The 3rd subclass of the principles will reflect aspects of the branch borders washing out process. This subclass is characterized by us as Specific since unusual players become participants of branch markets. They can apply original approaches and methods of economic activity to the considered branch (Kunyaev, Martynov, Starozhuk, 2018d).

The 4th subclass of the principles will reflect markets deregulation process aspects, taking into account the formation of a single information-communication environment to improve BACS management system effectiveness. We characterize this subclass as private, as its use by management personnel can solve problems related to information asymmetry (Kunyaev, Martynov, Starozhuk, 2018e).

3. Application of the authors classification to the organizational life cycle concept by BACS management systems within hypercompetitive MVBE

In modern competitive environment BACS management systems need an appropriate approach to assess and account for its impact at all of their life cycle phases. The latter is essential for solving problems connected with judgment objectivity about the BACS state and their development forecasts in a hypercompetitive MVBE. Thus, to solve the second problem, we will use results of work (Hanks, 1990) which describes in detail main LCO concept theoretical regulations and focuses on the following main phases: start-up phase; phase of expansion; maturity and subsequent diversification (or decline).

It should be noted that the class of principles will be taken into account at all phases because of its relevant feature – focus on ICE application via the latest ICTs (Kunyaev, Martynov, Starozhuk, 2018f). All this can contribute to the BACS management system effective use of various communication channels with intangible resources circulation.

At the start-up phase, as a rule, if the legal form and type have already been determined, organizations clarify their objectives, sources and other fundamental regulations. In this case, BACS management systems should use the 4th subclass of principles together with the class of principles under the deregulation of markets. In some cases, it is possible to expect market access low barriers due to the development of property rights, power, law, and legal support. It is closely connected to the removal of information asymmetry (Kunyaev, Martynov, Starozhuk, 2018e).

At the expansion phase, as a rule, organizations develop their structure, grow a number of hierarchies, identify shortcomings, clarify their mission in some cases, and much more (Hanks, 1990). In addition, the investment activity is activated at this phase, which typically leads to the organization shutdown point, since many indicators at this phase do not correspond to the business continuity. Therefore, in our opinion, it is advisable that BACS management systems should use the 1st subclass of principles along with the class of principles under globalization in conditions of the WICEE formation.

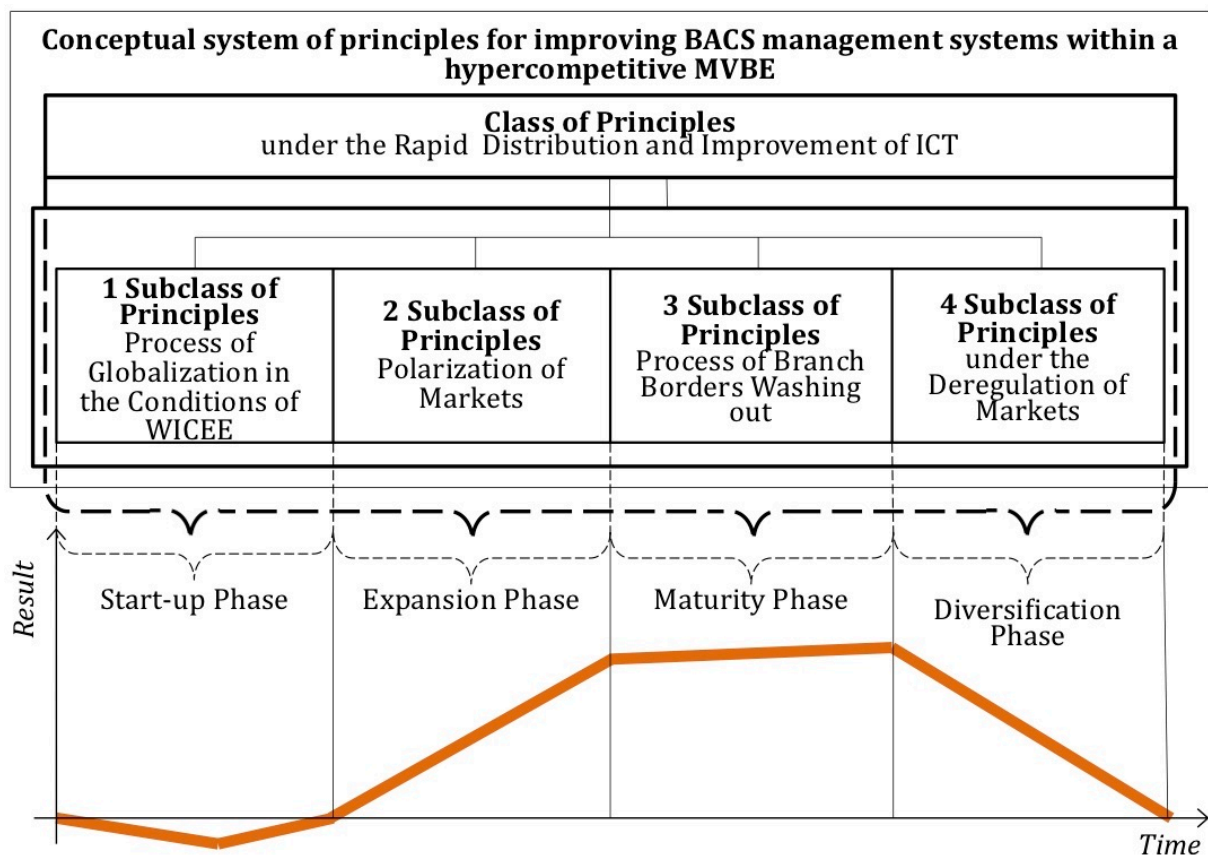
At the maturity phase usually comes the recognition of consumers, customers, suppliers, investors, etc. This phase involves production deconcentration. In this regard, it is essential that considered management system should use the 2nd subclass of principles together with the class of principles under the polarization of markets.

At the decline phase, organizations usually lose their competitive advantage because of the market share loss. This may be caused by the unpredictable and aggressive for the regarded market actions of competitors, including unusual ones. In this case, it is

important that management systems should use the 3rd subclass of principles along with the class of principles under the branch borders washing out in relation to the MVBE participants traditional rules behavior change, characteristic of the regarded branch, and specific players (Kunyaev, Martynov, Starozhuk, 2018d).

The above generalizations will be displayed in Fig. 3.

Fig. 3. Conceptual system of principles for improving construction sector business associations management systems within a hypercompetitive material-virtual business environment in relation to their life cycle main phases.



Source: Authors' Plotting

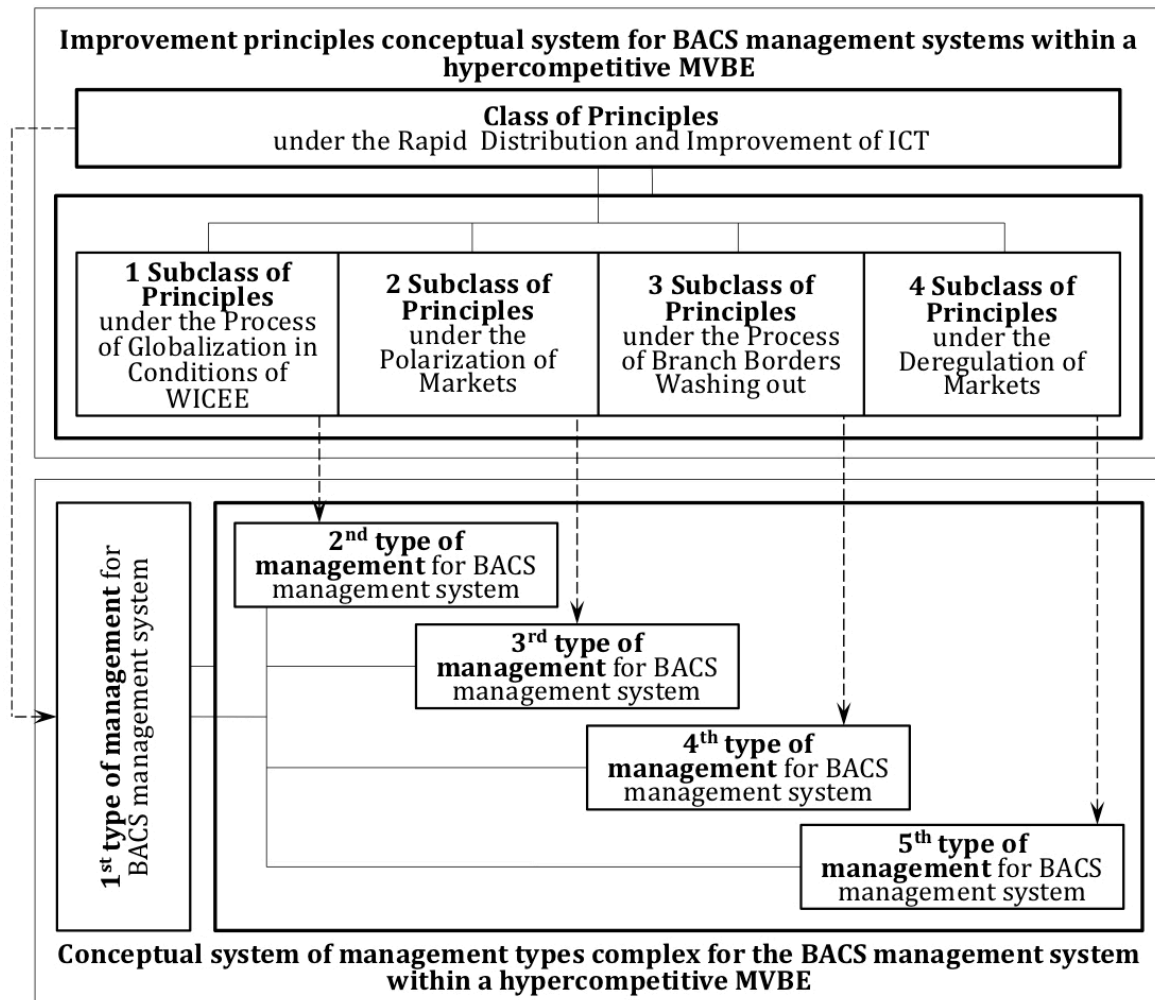
Conclusion

Thus, in conclusion, it is essential to highlight the following:

- the conceptual system of principles is classified to improve various business associations management systems in the modern MVBE conditions;
- elements of such classification and their application by the BACS management system with appropriate tools are the theoretical and methodological basis for identified by the authors new management types development according to the study of management

types complex – "Managementology" (Martynov, 2010). Fig. 4 schematically displays mentioned above model as a subject for the next publication based on our research.

Fig. 4: Management types complex development model on the basis of improvement principles conceptual system for the construction sphere business associations management systems within a hypercompetitive material-virtual business environment.



Source: Authors Plotting

- introduced in this article system-network approach to the resolution of issues within such an environment and Infocom method of purposeful interaction between BACS via ICTs are important for their systems management to consider in order to implement mediated communications. All this is designed to develop adequate methodological support for improving management systems of these business associations.

- the development of such a methodology designed to manage associations at all phases of the life cycle, in particular, within hypercompetitive MVBE is the desired result of further research on the regarded subject.

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Comparison of AHP and Kano model to evaluate the importance of customer requirements in product design

Abstract

Customer requirements are critical information when designing tangible products. Without knowing what the customer expects from the product, the validity of improving or innovation ideas cannot be guaranteed. Many design methodologies require that in addition to customer requirements also their importance should be known. Consequently, it represents very valuable information in further product planning steps - from development, through process steps planning to determining tolerance limits for statistical process and quality control. Several methods can be used to determine the importance of customer requirements, including the Analytic Hierarchy Process (AHP) and the Kano Model. Both of these approaches are rather the subject of integration efforts in the literature. Much less attention is paid to comparing the results of AHP and Kano in determining the importance of customer requirements. This paper aims to compare the results obtained by both methods in four views: (1) basic differences in determining the importance of customer requirements; (2) the tendency of methods to report extreme values of importance; (3) correlation between the importance of the requirements obtained through AHP and through Kano, (4) assessing the overall character of customer requirements' final importance. These results can help in both scientific and practical discussions about the advantages and disadvantages of AHP and the Kano model.

Key Words

Analytic hierarchy process, Kano model, customer requirements, importance, rating.

JEL Classification: L60, L11, L15, M11

Introduction

Customer requirements play a key role in product design processes. A market-successful product is often the result of a systematic analysis of what customers expect from it. The characteristics of the final product (e.g. shape, material, functions) are largely influenced by how the customer's requirements were defined at the beginning of development process. Several sophisticated techniques - such as Quality Function Deployment (QFD), Design for Six Sigma (DfSS) or Advanced Product Quality Planning (APQP) - are used to ensure the greatest possible intersection between what customers want and what a product actually gets. Whatever the way to analyze customer requirements is, the importance of each requirement is almost always taken into account. It is natural that the customer considers some of the requirements more important than others. Several methods have been developed in the past for rating customer requirements' final

importance. The most commonly used are the Analytic Hierarchy Process (AHP) (Li, 2009) and the Kano Model (Shen, 2000).

The AHP method was developed in the early 1980s by Saaty (1982). It is based on the psychological assumption that an individual will be able to assess the importance of two elements more easily than to assess all elements at once. By comparing all pairs of elements by using a simple mathematical apparatus, it is possible to calculate the relative importance of each element relatively accurately. The original idea of AHP has undergone several procedural modifications over time (use of fuzzy logic or rough set theory), but AHP has also been applied in almost any sector where objectification of decision-making has been required (Vaidya, 2006).

Fig. 1: Determination of CRs' importance using AHP

Scale	Definition	Description	CR_1	CR_2	CR_3	CR_4	CR_5	Sum	Raw importance
1	Equally importance	Two CRs contribute equally to objective	-	1/3	1/7	1	1/5	1.67	0.04
3	Moderate importance	Experience and judgement favour one CR over another	3	-	1/3	5	1/5	8.53	0.20
5	Essential or strongly importance	Experience and judgement strongly favour one CR over another	7	3	-	5	1	16.00	0.38
7	Very strongly importance	A CR is strongly favoured and its dominance demonstrated in practice	1	1/5	1/5	-	1/3	1.73	0.04
9	Extremely importance	The evidence favouring one CR over another is of the highest possible order of affirmation	5	5	1	3	-	14.00	0.33
2,4,6,8	Intermediate values between the two adjacent judgements	As compromise value is needed							

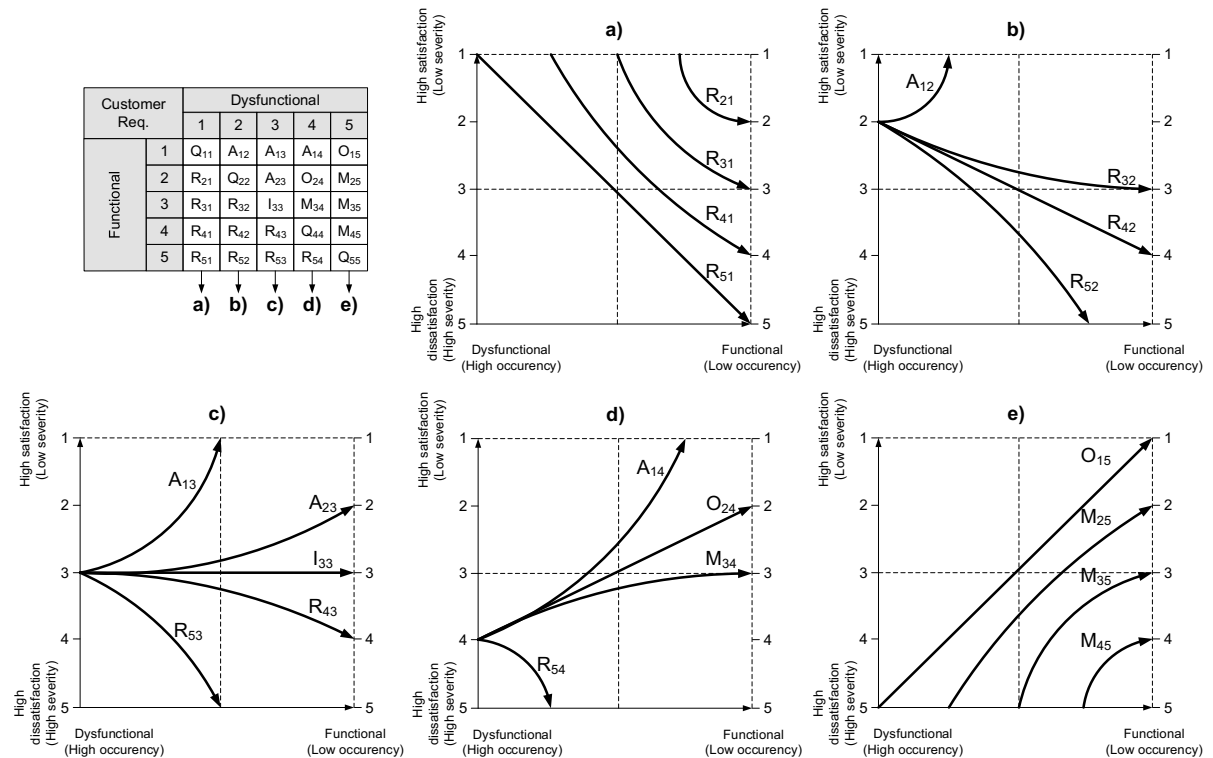
Source: (Song, 2014)

The Kano model was developed by a group of Japanese authors whose aim was to explain the nonlinear relationship between the fulfillment of the requirement and the resulting customer satisfaction. The Kano model distinguishes five valid request categories and one invalid - attractive, one-dimensional, must-be, reversal, indifferrent (and questionable). For example, attractive requirements only affect customer satisfaction, the must-be requirements have impact only on customer dissatisfaction and one-dimensional act equally on customer satisfaction and dissatisfaction (Shahin, 2013). The requirements are included in these categories on the basis of the Kano questionnaire and consequently on the so-called Evaluation sheet. The Kano questionnaire contains one positive and one negative question for each requirement (e.g. How would you feel if a nice music was playing in a restaurant? How would you feel if a no music was playing in a restaurant?). Respondents most often have one of five choices - from very dissatisfied to very satisfied. Answers are the input for categorizing a particular requirement (in this case "nice music") into individual groups. This categorization takes place by means of so-called Evaluation sheet. The Evaluation sheet is a 5x5 matrix displaying all 25 possible combinations for positive and negative responses.

The use of the Kano model to determine the importance of customer requirements was first published by Tan and Shen (2000). Their process has been improved several times with a view to increasing accuracy. At present it is possible to point out the way of determining the importance according to the so-called starting and ending points. It is a more precise way of determining the importance, as it eliminates the zone of discrepancy, which may cause inaccuracy of rating customer requirements' final importance. Any valid respondent response to a specific requirement can be plotted as a curve that has a start

and end point. The position of the "average curve" can then be calculated for several respondents. The area content that the curve makes with the so-called zero level (level with zero satisfaction and zero dissatisfaction) is consequently considered to be an importance of the requirement (Madzík, 2018b) (Madzík, 2019).

Fig. 2: Determination of CRs' importance using Kano



Source: (Madzík, 2018b)

Both approaches - AHP and Kano as well - show some benefits. While at AHP it is a rational and iterative assessment of importance, the Kano model has the advantage of identifying impacts of "quality" or "poor-quality". Several approaches can be found in the literature to integrate AHP and the Kano model to exploit the benefits of both (Li, 2009). Despite considerable interest in both methods, comparative results between AHP and Kano have not been adequately addressed in the literature till now. The studies aimed at application of AHP, Kano or their combination focus primarily on the customer requirements' final importance. Almost no attention is paid to how the final importance affects the use of a particular method. Comparing the difference in results may be enhanced by other related issues that can be formulated into the following research questions:

1. How will customer requirements final importance by AHP and Kano vary?
2. Does any of these methods tend to have extreme values of importance?
3. What is the correlation between the results obtained by AHP and the results obtained by Kano?
4. What is the overall character of values of customer requirements final importance?

So far, these issues have been only marginally addressed in the literature. A systematic analysis of the differences between the two methods can help answer these questions. To do this, a questionnaire survey and procedures explained in the Methods of Research chapter were used.

1. Methods of Research

A questionnaire on smartphones quality was used to answer four research questions. Quality attributes (i.e. customer requirements) of smartphones were used from an earlier study by the author of this article (Madzík, 2018a). There were 10 attributes used to form a two-part questionnaire. The first part of the questionnaire focused on the Kano model and contained two questions for each attribute - one positive and one negative. The second part of the questionnaire was focused on AHP and contained all the existing 45 pairs of attributes for which customers were to assess their importance. The identification characters of the respondents were not used because not the content of the survey but the comparison of the results was the aim of the research. The attributes in question - and thus the customer requirements (CR) - were as follows: CR_1: Smooth reactions, CR_2: High battery life, CR_3: High connectivity, CR_6: Good looking, CR_7: Display readability, CR_8: Additional services, CR_10: Overall ease of use.

Incomplete questionnaires were discarded from the resulting number of questionnaires and data were subsequently transferred into spreadsheet environment. The importance values of each requirement were calculated for each respondent based on the methodology presented in the Introduction section. This data has been exported to the Minitab Statistical Software environment for specific procedures. The results are displayed in graphical and table form in the Results section. To answer the first question - concerning the differences in results between AHP and Kano - standard tools of descriptive statistics were used and the results were displayed through boxplots. To answer the second research question - exploring extreme values - Grubbs' test of extreme values was used. The third question - the correlation between AHP and Kano results - was examined through linear regression analysis and more detailed residual analysis. The last fourth question - the nature of importance values - was examined through a graphical representation through marginal plot and statistical diagnostics of different types of distributions.

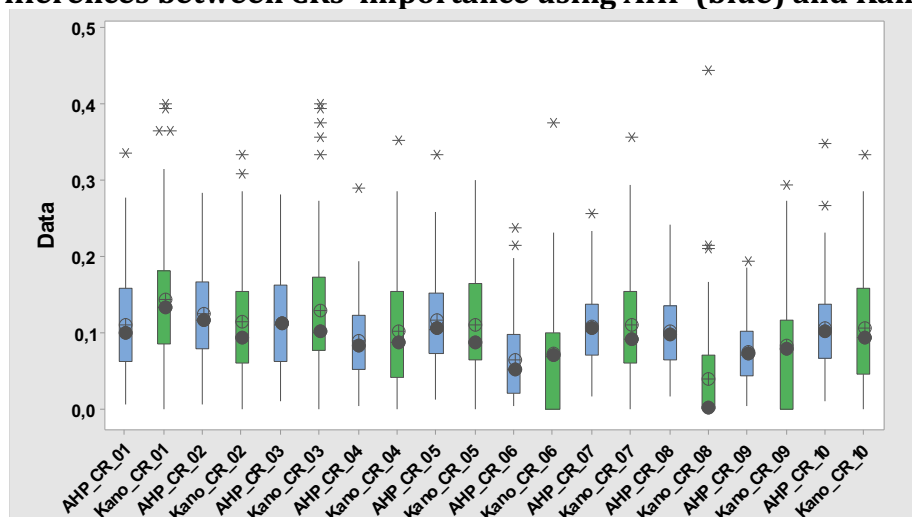
2. Results of the Research

The sample consisted of 104 valid and fully completed questionnaires. Four of these research questions could then be analyzed systematically. Results from this analysis are found in the following sub-sections.

2.1 Customer requirements' final importance differencies

Using AHP or Kano model can produce different results in terms of customer requirements final importance. Position measurements such as mean, median, mode, or variability rates can be used to show these differences. A summary graphical representation of the differences in the importance of each requirement can be found in Figure 3 in the form of boxplots.

Fig. 3: Differences between CRs' importance using AHP (blue) and Kano (green)



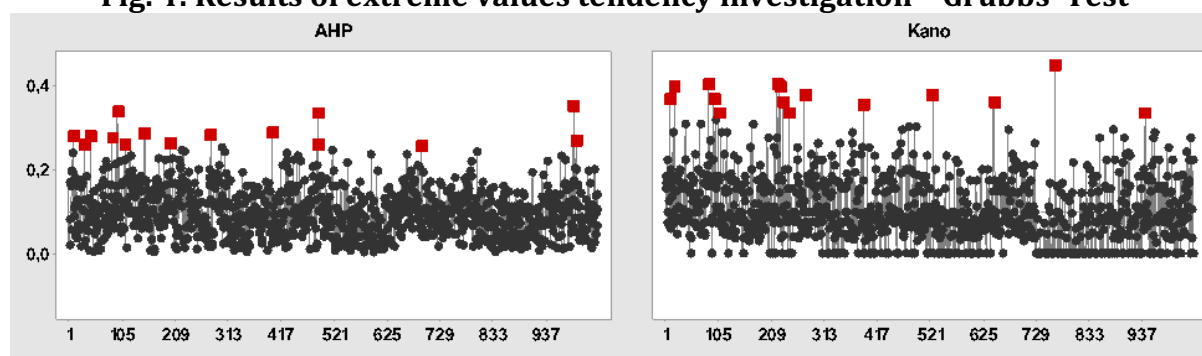
Source: authors' own calculations

As it can be seen from the figure, the Kano model shows a higher variability of values than AHP for some requirements. However, this is a relatively small difference - the standard deviation for AHP was 0,057 and 0,078 for Kano. However, both methods showed a relatively consistent level of importance for virtually all CRs, except for CR_08 Need for manual maintenance. This requirement, according to the Kano methodology, came out as indifferent - that is, it does not affect either satisfaction or dissatisfaction - and therefore the median is significantly lower than for AHP. Nevertheless, it can be stated that the results of both methods will bring very similar customer requirements' final importance.

2.2 Extreme values tendency

Tendencies to significantly low or significantly high attribute importance levels can have a negative impact on the accuracy of other product design stages. Testing extreme values can be useful information to reduce the risk of inaccuracy. Results of Grubbs' Test are shown in Figure 4 for both examined methods.

Fig. 4: Results of extreme values tendency investigation – Grubbs' Test



Source: authors' own calculations

Both methods do not have a definite tendency to show extreme values of importance. Grubbs' Test for outliers assesses the position of values in relation to normal distribution. Also for this reason the extreme values are identified on the positive side of the numeric axis, because any importance lower than 0 is illogical.

2.3 Correlation between AHP and Kano results

A linear bivariate correlation analysis was used to examine the similarity between results obtained by AHP and Kano. It should be noted that the results were compared for each individual respondent. In total, 104 questionnaires were examined, each of which contained 10 customer requirements. The results are shown in Table 1.

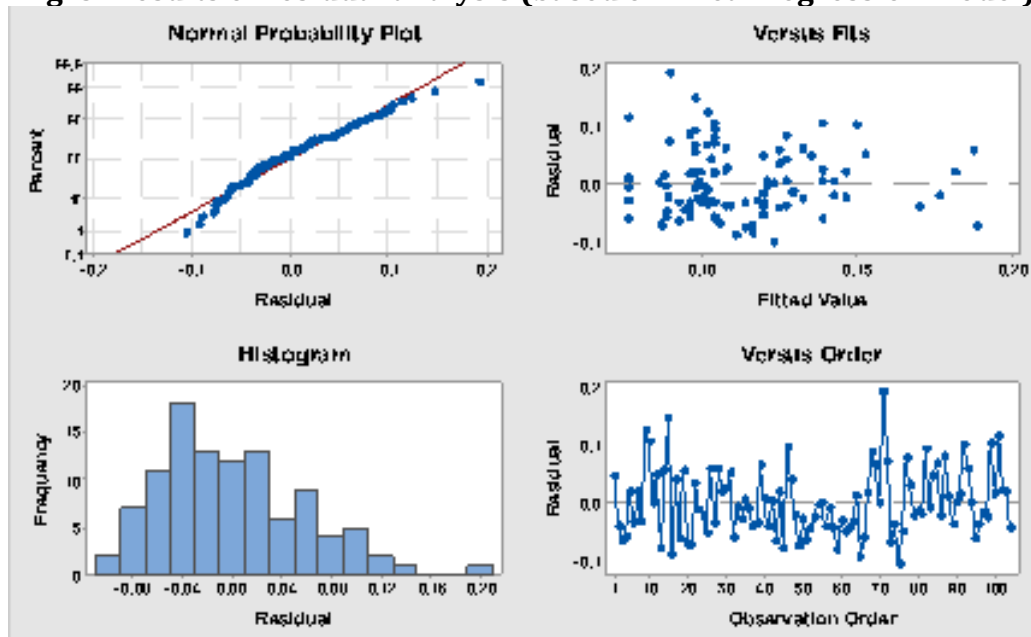
Tab. 1: Results of bivariate correlation analysis

AHP Kano	CR_01	CR_02	CR_03	CR_04	CR_05	CR_06	CR_07	CR_08	CR_09	CR_10
CR_01	0.12	-0.10	0.09	-0.07	-0.30**	-0.08	0.21*	0.02	-0.13	0.20*
CR_02	-0.01	0.15	-0.19	0.06	0.00	-0.11	0.11	0.00	-0.07	0.04
CR_03	0.01	0.08	0.38**	-0.16	0.10	0.10	-0.07	-0.22*	-0.14	-0.20*
CR_04	-0.05	0.03	-0.14	0.36**	0.04	-0.09	0.01	0.02	-0.01	-0.07
CR_05	0.04	0.08	-0.13	0.05	0.22*	-0.01	-0.02	-0.10	0.01	-0.13
CR_06	0.09	-0.03	0.12	-0.13	0.12	0.25*	-0.16	-0.02	-0.18	-0.16
CR_07	0.04	-0.19	0.08	0.00	-0.17	-0.07	0.09	0.04	0.07	0.12
CR_08	-0.20*	-0.18	0.01	0.14	0.06	0.07	0.04	0.11	0.04	0.00
CR_09	0.04	-0.02	-0.09	-0.12	-0.06	0.13	-0.16	0.06	0.27**	0.00
CR_10	-0.07	0.15	-0.15	-0.11	0.01	-0.21*	-0.02	0.09	0.11	0.21*

Source: authors' calculations

The statistical significance is assessed based on a p-value basis, with the correlation coefficients denoted by *, p-value <0,05 and the correlation coefficients denoted by ** are p-value <0,01. Nevertheless, the relationships can be described as relatively weak, since the highest Pearson correlation coefficient was identified at the CR_03 requirement at 0,38. Whether it is a natural phenomenon or some other risk has appeared, has been examined through a residual analysis of this particular case - Figure 5.

Fig. 5: Results of residual analysis (based on linear regression model)



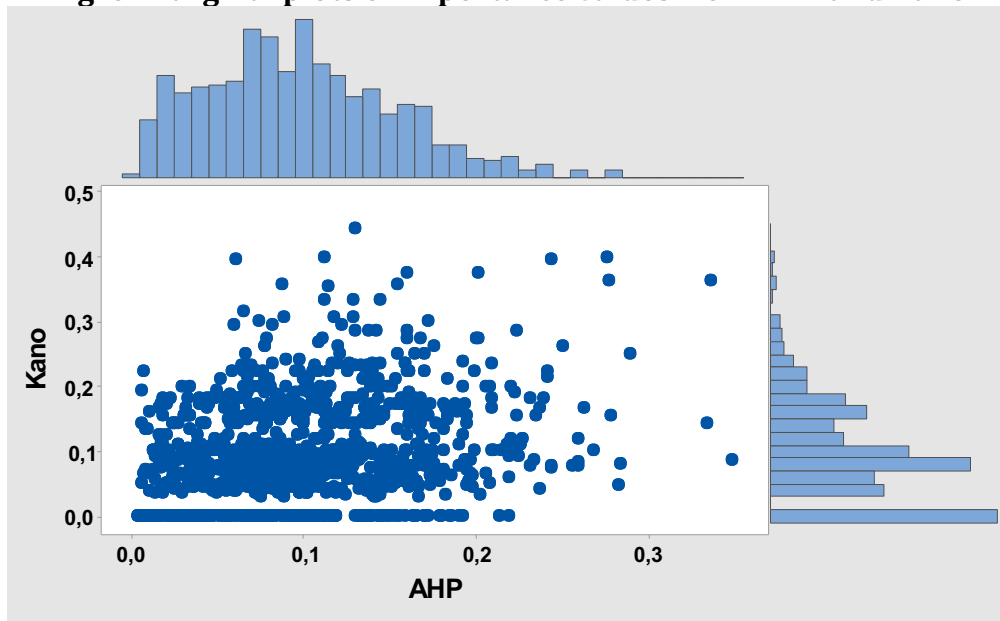
Source: authors' own calculations

In the case of CR_03 requirement importance, the residuals (difference between data point and trend line) have a normal distribution. The analysis also did not detect any system errors that could be caused by errors in data or by observation order. On this basis, it can be concluded that AHP and Kano produce significantly different results of the importance of the requirements when the importance is calculated for one respondent.

2.4 Overall character of values of customer requirements' final importance

Of the 104 questionnaires, 10 CRs were assessed. Thus, 1040 valid values of importance were available from both the AHP method and the Kano method. These values could then be further analyzed to better understand the nature of AHP and Kano methodology. The analysis consisted of two steps - statistical and graphical. Statistically, it was found that both methods did not show the characteristics of standard distributions. Goodness of fit tests were performed for these distributions: Normal, Box-Cox Transformation, Lognormal, 3-Parameter Lognormal, Exponential, 2-Parameter Exponential, Weibull, 3-Parameter Weibull, Gamma, 3-Parameter Gamma, Logistic, Loglogistic and 3 -Parameter Loglogistic. However, no statistically significant level was found that would associate the use of AHP or Kano with a particular type of distribution. Therefore, a graphic interpretation of the values was performed - Figure 6.

Fig. 6: Marginal plots of importance values from AHP and Kano



Source: authors' own calculations

Values from both methods are right-skewed. In the case of AHP, the values are more concentrated - the range is 0,34 - than in the case of Kano - the range reached 0,44. An interesting finding is that the mode for the Kano model is 0, while for the AHP it is 0,1. This, of course, also affects the height of kurtosis. While at AHP the kurtosis value was 0,61, at the Kano model it was 1,03. This is relatively interesting as the standard deviation results first suggested less concentrated numbers for the Kano model.

According to the presented results, two methodological and practical conclusions can be concluded. One of them is that the AHP method shows fairly balanced values of importance, with no particular value dominating. From a practical point of view, this is a

very useful piece of information that says that using AHP does not underexpose less important requirements or overexpose those of higher importance. Kano methodology, on the other hand, tends to completely eliminate lower-importance requirements - gives them the importance of 0. The Kano median is lower than that of AHP (0,095 vs. 0,087), meaning that with Kano the importance values will probably be lower or equal to zero. From a practical point of view, it can also have its benefits, especially when it comes to product innovation. Product requirements or features that are considered to be self-evident will be underestimated by Kano (as opposed to AHP) and only critical requirements or functions will be emphasized.

3. Discussion

The presented results bring several scientific and practical applications that can be briefly characterized. The results showed that both methods are relevant for determining importance and can achieve relatively reliable results. However, this is only true if the importance of the requirements is calculated for the whole group of respondents (final importance ratings). In cases where it is necessary to calculate the importance of the requirements for one respondent and thus create customer segments with similar characteristics, the methods differ radically. This finding partly contradicts previously published studies that used AHP or Kano for customer segmentation (Wu, 2009) (Rezaeinia, 2012). We believe that such a difference can be caused by an object to which the use of the method applies. While in AHP the importance is determined directly, in Kano, the importance is derived indirectly by determining hypothetical satisfaction. However, it cannot be said that the Kano model is therefore an irrelevant tool for determining the importance of requirements. Kano rather observes the effects of fulfillment respectively failure to meet this or that requirement (Shahin, 2013). Our results indicate that using Kano can lead to underexposure of less important requirements and overexposure of more important requirements. The selection of critical quality attributes is particularly important in radical product innovations (Tontini, 2007). Neither the Kano model nor the AHP had a tendency to reach extreme values of importance. This is a very valuable finding, as many previous studies have pointed out that too high or low values of the importance of customer requirements can lead to incorrect product characteristics (Madzík, 2019). The results of this study can be a source of information when deciding how to determine the importance of customer requirements. They can thus support design techniques such as QFD, DfSS or APQP (Kulkarni, 2000). This study was aimed at determining the importance of a tangible product, but its results also go beyond to the service sector. Methodologies for designing service characteristics - such as SERVQUAL (Service Quality) or IPA (Importance-Performance Analysis) - also often work with the importance of customer requirements (Ayeh, 2013). In the application respect, we can find implications of our results on topics related to marketing analysis (Križo, 2018), decision support or problem-solving tools.

Conclusion

The present study offers a comparison of the results of determining the importance of customer requirements by means of two methods - AHP and Kano. Such a comparison was based on the processing of the results from a questionnaire aimed at the quality of smartphones. The results pointed to similar features of both methods (determining the cumulative importance of requirements, low risk to extreme values) as well as their different features (determining the individual importance of requirements, exposing values to the Kano method). The paper offers both theoretical implications related to the methodological aspects of customer requirements processing and practical implications for product design activities and processes.

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TOPSIS Technique and Its Theoretical Background

Abstract

In the 21st Century, decision-making on the basis of incomplete, different or all available information is a necessity which must be faced by any entity wishing to be competitive. The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) as one of multi-criteria decision making (MCDM) method represents a practical tool for the selection of a greater amount of alternatives (as one of the most popular, resp. most commonly used). The main contribution of this article is to present the TOPSIS technique as an adequate instrument for comprehensive evaluation. Pros and cons of this methods and also its calculation are described, e.g. easy use, rationality, understanding on the one hand and on the other absence of the possibility to allocate weights to the selected criteria. It can be also said that it is possible to find many different descriptions of the calculation process (from 5 to 9 steps). We believe that the TOPSIS technique is a suitable tool for complex assessment which can be applied in various areas of the public and private sector. However, attention must be paid to the selection of criteria and to the method of determining their weight, which has a significant impact on the overall result of the analysis.

Key Words

MCDM methods, TOPSIS technique, calculation, description

JEL Classification: C44, D81, P34

Introduction

In the last decades, making decisions on the basis of several criteria has become a fast growing area reflecting continuous changes in various economic sectors. The issue that MCDM (multi-criteria decision making) methods intend to solve is the identification and assessment of the best variant among all available options. According to Cereska et al. (2018), the main idea of MCDM methods is joining of evaluation criteria values and their weights to single evaluation characteristics, i.e., criteria of the method. MCDM methods implement the maximized (beneficial) criterion, in the case where maximum value of criteria corresponds the best one (profit, for example), and the minimized one, when the best value of criteria is minimal (expenses, for example). There are several tools in MCDM, used by many authors like Aouadni et al. (2017), Guarini et al. (2018), Yalcin, Unlu (2018), Noryani et al. (2018), etc., to select the best variant based on several criteria. From the methods used, we can mention analytical hierarchy process (AHP), analytical network process (ANP), complex proportional assessment (COPRAS), data envelopment analysis (DEA), Elimination and Choice Expressing the Reality (ELECTRE), Preference Ranking Organization Method for Enrichment Evaluations (PROMETHEE), technique of ranking preferences by similarity of the ideal solutions (TOPSIS), Vlse Kriterijumska Optimizacija Kompromisno Resenje (VIKOR) or others.

Tab. 1: Description of some methods included in the review

Method	Description
AHP	Structured technique for analysing MCDM problems according to a pairwise comparison scale.
ANP	Generalisation of the AHP method which enables the existence of interdependences among criteria.
COPRAS	Stepwise method aimed to rank a set of alternatives according to their significance and utility degree.
DEA	Non-parametric system for measuring the efficiency of a set of multiple decision-making units.
ELECTRE	Group of techniques addressed to outrank a set of alternatives by determining their concordance and discordance indexes.
PROMETHEE	Family of outranking methods based on the selection of a preference function for each criterion forming a MCDM problem.
TOPSIS	Technique based on the concept that the best alternative to a MCDM problem is that which is closest to its ideal solution.

Source: authors' own processing

Tramarico et al. (2015) reported a trend of application of MCDM tools which was obtained from published articles in year 1990 to 2014. From the study, AHP was the commonly applied MCDM tool and followed by TOPSIS and ANP. The lowest application of MCDM tool that found in published articles was MAUT (Noryani et al. 2018). Similar conclusions, i.e. frequent usage of the TOPSIS technique in renowned journals are published in the research of e.g. Zavadskas et al. (2016) or Keshavarz Ghorabae et al. (2017).

1. TOPSIS technique as an Adequate Instrument for Comprehensive Evaluation

The TOPSIS technique proposed as an alternative to the ELECTRE method by Yoon and Hwang was based on the idea that when an alternative has the shortest distance to the ideal solution, it can be considered as the best one (Zavadskas et al. 2016). The objective of the MCDM is to find the most desirable alternative(s) from a set of available alternatives versus the selected criteria. The result of this method can be described as a solution whose distance from the Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS) is the same. Opricovic, Tzeng (2002) describe PIS as a solution, an alternative that maximizes revenues criteria while minimizing cost criteria. NIS can be described as its opposite, i.e. NIS maximizes cost criteria and minimizes revenues. According to Shih, Shyr, Lee (2007), TOPSIS enables the decision maker to solve and analyze the problem, to compare alternatives and to rank them on the basis of selected criteria. At the same time, this method is referred to as the most direct method of MCDM, while according to Pavic, Novoselac (2013) this method is the most appropriate decision-making tool when it comes to incomplete data. According to Kandakoglu, Celik, Akgun (2008) and Shih, Shyr, Lee (2006) the range of selected data is not determinant for its use, i.e. it is possible to use data of any range.

Tab. 2: Advantages and disadvantages of TOPSIS technique by selected authors

Advantages	Disadvantages	Author
Compensatory methods that allow trade-offs between criteria, where a bad result in one criterion can be cancelled by a good result in another criterion.	Do not consider the correlation of the attributes, difficult to weight and keep consistency of judgment.	Noryani et al. (2018)
The logic representing the rationality of human choice and the general value taking into consideration the best and the worst values of criteria.	Do not providing for weight elicitation and consistency checking for judgments.	Shih et al. (2007)
It determines a solution with the shortest distance to the ideal solution and the greatest distance from the negative-ideal solution.	It does not consider the relative importance of the distances from these points.	Opricovic, Tzeng (2004)

Source: authors' own processing

The perception of the advantages and disadvantages of this method differs due to their use in different situations and contexts. When comparing with other relevant methods (AHP, ELECTRE), Shih, Shyur, Lee (2007) outline the following advantages of the TOPSIS method:

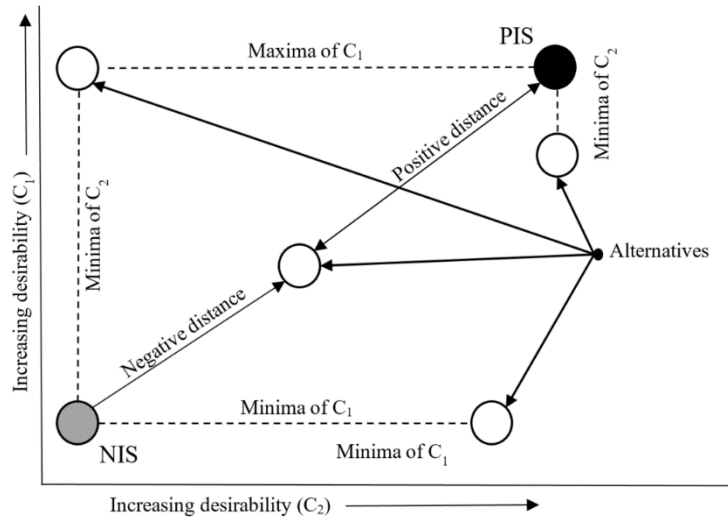
- a) the logic representing the rationality of human choice,
- b) the general value taking into account the best and worst values of the criteria,
- c) simple calculation which can be easily programmed,
- d) the result of alternatives can be illustrated by polyhedron (min. in 2 dimensions).

Bhutia, Phipon (2012) also add the following:

- a) easy use,
- b) the ability to work with all types of criteria (subjective and objective),
- c) rationality and understanding,
- d) the directness of the calculation,
- e) the concept illustrates the best alternative through mathematical calculations.

Kandakoglu, Celik, Akgun (2008) and Shih, Shyur, Lee (2007) consider the absence of the possibility to allocate weights to the criteria and lack of consistent control by the decision maker as the main disadvantage of the the TOPSIS method. For this reason, this method is dependent on relative importance of different attributes while bearing in mind the set goal. One of the most important factors throughout the process is the decision-maker.

Fig. 1: Graphical presentation of TOPSIS technique



Source: authors' own processing based on (Tramarico et al., 2015)

2. Description of TOPSIS calculation

In case of the TOPSIS method usage, the authors differentiate between 5 steps (Wu, Hsieh, Chang, 2013, Opricovic, Tzeng 2002) and to 9 steps (Hashemkani Zolfani, Antucheviciene 2012). The first step when using TOPSIS is to build a matrix that, according to Milani, Shanian, El-Lahham (2008) ranks alternatives according to the respective pre-identified criteria (characteristics):

$$D = \begin{pmatrix} & X_1 & X_2 \dots & X_j \dots & X_n \\ A_1 & x_{11} & x_{12} \dots & x_{1j} \dots & x_{1n} \\ A_2 & x_{21} & x_{22} \dots & x_{2j} \dots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ A_i & x_{i1} & x_{i2} \dots & x_{ij} \dots & x_{in} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ A_m & x_{m1} & x_{m2} \dots & x_{mj} \dots & x_{mn} \end{pmatrix} \quad (1)$$

where: A_i - i-th variant,
 x_{ij} - value of j-th criterion reached by i-tj variant

In the next step, this matrix is normalized using the relationship:

$$r_{ij} = x_{ij} / \sqrt{\sum_{j=1}^j x_{ij}^2} \quad (2)$$

where: r_{ij} - normalized value of j-th criterion reached by i-tj variant
 x_{ij} - value of j-th criterion reached by i-tj variant

$$v_{ij} = w_{ij} \cdot r_{ij} \quad (3)$$

where: v_{ij} - weighted normalized value
 w_{ij} - criterion weight
 r_{ij} - normalized value

The normalized matrix thus obtained contains values from which PIS and NIS can be identified. These variants can be both real alternatives and hypothetical alternatives (out of the best or worst achieved results). The identification of PIS and NIS can be represented by the following relationship:

$$H_j = \max(w_{ij}), D_j = \min(w_{ij}) \quad (4)$$

where: H_j - positive ideal solution (PIS)
 D_j - negative ideal solution (NIS)

The distance of thus obtained PIS and NIS can be calculated according to:

$$d_i^+ = \left[\sum_{j=1}^k (w_{ij} - H_j)^2 \right]^{1/2}, d_i^- = \left[\sum_{j=1}^k (w_{ij} - D_j)^2 \right]^{1/2} \quad (5)$$

where: d^+ - distance to PIS
 d^- - distance to NIS

From the perspective of alternatives, the desired minimization of distance from PIS is (d^+) and maximization of distance from NIS is (d^-). The relative distance from PIS is the basic criterion for setting the rank of an alternative. This criterion, by means of the relationship below, takes into account the two identified distances from the previous step.

$$c_i = \frac{d_i^-}{d_i^- + d_i^+} \quad (6)$$

where: c_i - relative distance from PIS

The final step that some authors (Milani, Shanian, El-Lahham 2008) do not mention as a step under the TOPSIS method is the ranking based on the relative proximity to the PIS alternative. The best rated alternative (subject) is an alternative with the highest value achieved.

Conclusion

The classical TOPSIS method can be effectively used as an alternative way to combine different individual performance indicators/criteria into a composite index with the purpose of comparing and ranking given alternatives (Zavadskas et al. 2016). TOPSIS has also been used to compare company performances (Deng et al. 2000) and financial ratio

performance within a specific industry (Feng, Wang, 2000). Demirelli (2010) determined the performance of state-owned commercial banks that extensively operate nationwide by using TOPSIS in Turkey during the period of 2001-2007. Its use was identified by Olson (2004) in manufactories, financial investment, sports team evaluation, automated processes. The method was also used to compare the performance of multiple companies as a financial index for performance evaluation in a specific area that allowed detailed comparisons. It is also possible to find its application also in tourism (Yin et al. 2017), risk assessment (Radulescu, Radulescu, 2017), evaluation of territorial self-governing bodies (Vavrek et al. 2015), groundwater quality classification (Zahedi et al. 2017), and many others. Based above-mentioned pros and cons TOPSIS we can conclude that the method could be used for evaluation based on several criteria. Its usage should be considered, but at the same time the main disadvantage should be mentioned too - its result totally depends on the weight used. We recommend paying attention to weight determination as a key phase of its application.

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Section III

Transparency In the Public Sector

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Gift vs Bribe: What Counts As Corruption?

Abstract

This paper builds theory concerned with the conceptual interpretation of the corruption threshold. In order to find the key to this issue, we ask, approximating corruption with a bribe, the following questions: (i) What is the threshold for corruption? and (ii) What is the difference between a bribe and a gift? Since this paper intends to conceptualise this phenomenon, which is seldom inquired about in qualitative, conceptual terms, we employ qualitative methodology to discuss our research questions in semi-structured interviews. Due to the necessity to access the information related to the threshold between gifts and bribes, we conduct a study with Czech managers due to the Czech managerial culture being one of gift-giving (Myant and Smith, 2006). We find, using Braun and Clarke's (2006) protocol for thematic analysis of semi structured interview data, that the fundamental threshold for corruption is anything of a monetary nature; the threshold between bribery and a gift seems much less straight-forward with the intention, nature, timing, beneficiary and value being highlighted. Additionally, we find that whilst consensus is available for the former factors, the value of a 'gift' is highly subjective. Moreover, a great disparity is apparent between the public and private sectors. We consequently discuss these findings and their implications for practitioners and legislators.

Key Words

corruption, bribery, gifts, business ethics, gift culture

JEL Classification: D9, K2

Introduction

Corruption is a well-researched phenomenon, mostly in terms of its contextual settings - both sectoral and geographical. There are also many studies seeking to define corruption which, due to the context specificity of the phenomenon, yield different, sometimes even conflicting, results. However, in spite of these theoretical clashes, the commonly accepted definition of corruption is an act of power abuse or "unreasonable preferential treatment" (Dion, 2013, p.412) by abusing one's power or authority to extract rent and/or otherwise satisfy one's selfish needs (Jain, 2001; Svensson, 2005). Regardless of the consensus, however, "different people ... mean different things by corruption" (Bardhan, 2006, p.341). The delimitation of trust encounters an additional difficulty when discussing the threshold for corruption. This is mostly due to corruption being subject to the context, subject(s) of exchange and the individuals involved in the corrupt transaction. A possibility of examining the threshold for corruption has been proposed by Tanzi (1998) who suggested that the question which corruption scholars should be asking is "at what point does a gift become a bribe?" (p.25); and whilst some suggest that a bribe is not corruption per se, it is certainly the most obvious sign of corruption and association people have when asked to define corruption (Khalil, Lawaree and Yun, 2010). Therefore,

this paper asks: (i) What is the threshold for corruption? and (ii) What is the difference between a bribe and a gift?.

The studies aiming to answer these questions are, in comparison with the volume of corruption literature, small in number. Perhaps the most common approach to answering this question is one that employs various games and observations based experiments, such as Abbink, Irlenbusch and Renner (2000, 2002) or Lambsdorff and Frank (2010), which inform us mostly about individuals' behaviour when being bribed, often related to opportunism, profit maximisation, reciprocation and whistleblowing. There are also some studies available that ask this question in a specific context, such as that of Moldovan and Van de Walle (2013) who explored the context of the Romanian health care system, finding that bribes are often referred to as gifts despite the acknowledgment of their exceedingly high value and the inappropriateness of the intent in giving and receiving them from those involved in the transactions. Despite the informative value that these results hold, they tell us a lot about specific transactions and behaviour under corruption, without telling us much about the underlying theory of gift giving and the point at which a gift becomes a bribe.

The lack of understanding of the actual threshold between a gift and a bribe can cause a number of problems, considering that this is the way the law most commonly regulates bribery and corruption. Therefore, in order to set such a threshold at a value that best fits the requirements of the concerned environment, we need to understand how individuals reason the gift vs bribe dilemma and what are the factors they take into consideration. Unfortunately, since corruption studies are predominantly of a quantitative nature, we do not have this in-depth, individual-level information available. Such information should be crucial given the view that corruption means something different for different people (Bardhan, 2006) and even more so that it seems to mean something else for different businesses (Gordon and Miyake, 2001). This study addresses this gap by attempting to build theory informing us about the said issue.

Addressing this gap requires a particular context that would grant us the answers to our questions. A culture of gift giving which, at the same time, uses bribery in its transactions - both social and business ones - seems ideal. Moreover, this is supported by the study of Gordon and Miyake (2001) who found that a reference in firms' codes of conduct, relating to bribery vs networking, have been made, particularly to the reciprocity of a gift-exchange and culture of gift-giving. We identified the Czech Republic and its business environment as a particularly suitable case for our study. This is due to the strong culture of gift-giving and the relatively common occurrence of bribes in both Czech society and business operations (Myant and Smith, 2006). The Czech Republic, however, provides an additional advantage in that it has a well-developed economy which is integrated in the global economy with a number of multinationals and therefore expatriates working and living in the business environment and the country. This gives Czech business people the opportunity to reflect on the, often overly, transparent environments elsewhere in light of the Czech one (Rose-Ackerman, 2002). This reflective process allows for the conceptualisation of norms, standards and personal ethics which increases the capacity of Czech managers to report on these issues (Patterson, 2001; Clarkeburn, 2002); thus providing a balanced view stemming from the position of a culture of gift-giving and that of highly regulated and transparent environments.

1. Methods of Research

Our study uses in-depth semi-structured interviews conducted with 12 Czech senior and top managers and firm owners operating in the Czech business environment as its data collection instrument. Table 1 provides information about our respondents to whom we assigned pseudonyms to ensure anonymity.

Table 1: An Overview of Study Respondents¹

	Age	Edu	Loc	Bus	Firm	DM	For
Andrew	35/45	MSc	PRG	B2B	Corp.	No	Africa
Barbara	30/40	MSc	LBC	B2B	MNC	No	EU/US
Cindy	30/40	MSc	PRG	B2C/B	FL/MNC	Yes	EU/US
Don	30/40	MSc	PRG	B2B	MNC	Yes	EU
Emily	35/45	MSc	PRG	B2B	MNC	No	US
Fiona	35/45	MSc	PRG	B2B	Corp.	No	No
Gert	25/35	Col.	KH	B2C/B	Corp./MNC	Yes	No
Harvey	30/40	Col.	KLN	B2C	Corp.	Yes	No
Irma	25/35	Col.	PRG	B2C/B	FL/MNC	Yes	EU
Jose	25/30	BA	PRG	B2C/B	SME/MNC	Yes	EU
Kirk	50/60	MSc	PRG	B2B	SME	Yes	No
Leslie	30/40	MSc	LBC	B2C/B	FL/SME	No	No

Source: Analysis of interview transcripts

Our interviews were analysed by means of a discourse analysis. We followed the 6-stage protocol for thematic analysis suggested by Braun and Clarke (2006). Our data were analysed manually on the basis of the original transcripts in the Czech language, without the use of any software package in order to maintain control over the process, and also to retain the richness of the original data which is tied to the specifics of the Czech language. The analysis of translated data would cause a significant loss of the meanings which are embedded in the interview (Czech) language.

2. Results of the Research

This section presents data pertaining to the research questions: (i) What is the threshold for corruption? and (ii) What is the difference between a bribe and a gift? The analysis highlighting that the difference between a gift and a bribe builds up on the general threshold for corruption, we answer our first question pertaining to this issue first. Our respondents have said, and are all in agreement, that, for them, corruption is a quid-pro-

1 LEGEND: {**Edu** (education): MSc (masters), BA (bachelor), Col. (college)}; {**Loc** (location): PRG (Prague), LBC (Liberec), KH (Kutna Hora), KLN (Kolin)}; {**Bus** (business context): B2B (business-to-business), B2C (business-to-customer)}; {**Firm**: Corp. (corporation), MNC (multinational corporation), FL (freelancer), SME (small to medium business)}; {**DM** (decision making position): Yes (currently in DM), No (currently not in DM; however, has been in a DM in past)}; {**For** (experience of working abroad): No (no experience working abroad)}.

quo marked by bribery which is of either a financial/monetary or a material/non-financial form. The monetary form, regardless of the value, clearly signifies corruption: e.g. “[m]oney is a very blunt way ... if someone is stupid and wants to [bribe someone] with CZK100 then it is the same for me as if someone tries doing it with CZK10,000,000” (Jose); “[i]f it is a diary - even an expensive one - then that’s a nice token but an envelope - why money[?!] ... money is ‘swine-like’ ... it is literally like saying ‘I am buying you!’” (Fiona) or “[t]here is definitely a massive difference between money and a thing ... if you put CZK1000 next to a thing for CZK3000 then you would always feel that it is the banknote that’s unethical” (Irma). This finding shows a very clear delimitation of corruption where our respondents would not hesitate to determine whether what they see is corruption or belongs to a different category; however, this is an issue which brings us to our second question: If money is always considered to be corruption, then what about gifts and material ‘support’? Where do we draw the line between a gift or a favour and a bribe?

Drawing the line between a gift and a bribe is not a straightforward exercise, unlike that of determining the threshold for corruption. Importantly, our respondents still report a gift culture in the Czech business environment as well as society. As Emily puts it, gifts and dinners are “*part of the managerial culture ... top managers have their businesses based on these excellent relationships*”; however, gifts were said to be common in the public sector too. Before presenting our findings, we would like to reemphasise that, like the corruption threshold, our findings of the gift-bribe threshold are in alignment with the monetary threshold, or as Harvey puts it “*I would divide this [threshold] into financial where the tolerance would be zero and then material as a thank you - but a thank you should never be financial*”. In answering our question pertaining to the threshold for a gift and a bribe, we have extracted three main recurring themes: (i) **‘the ‘gift’s’ nature and value’**; (ii) **‘timing, intention and beneficiary matter the most’** and (iii) **‘gifts in the public vs private sector’**.

The (i) **‘the ‘gift’s’ nature and value’** was perhaps the most commonly mentioned issue by our respondents. They suggested that both the nature and value of a gift depend on the context. However, this seemed to be more valid for the value of a gift, rather than its nature. The nature of a gift has been described by all our respondents as something that indicates gratitude, a token to say ‘thank you’ and to show appreciation or to give one something for Christmas: e.g. “*it is a gift to say thank[s] ... a symbol of gratitude ... a reward for a nice partnership ... as a relationship development*” (Jose); “*half a pig would be too much, and most importantly it is quite a personal thing*” (Kirk); “*private gift is, of course, inappropriate*” (Irma); “*small things ... they are ... part of the culture and business*” (Gert); “*just a thank you for the cooperation [is a gift]*” (Fiona); “*[a gift would be ok] but a normal one ... you cannot accept an invitation to a holiday, that’s absurd*” (Don) or “*I think that my boundaries are really set by the bottle of wine for Christmas ... it could even be a good bottle, it’s perhaps more about the character of the gift*” (Barbara). However, the nature of the gift alone will not suffice as a threshold, since it is also about the value of these gifts. Indeed, our findings suggest that even a ‘simple’ gift, such as a bottle of wine, can cross the line if it exceeds certain value: “*a gold ring for 20,000 is not the same gift as a box of chocolates*” (Andrew); “*there is a difference between a normal bottle of wine and a bottle for CZK3000 - that’s not normal, that’s a clear bribe*” (Don); “*look, you have deals worth hundreds of millions of dollars, and the lunch is always worth CZK5000*” (Fiona); “*I would not see a weekend somewhere as a corruption - but then you can have a weekend stay for CZK2000 or*

CZK20,000" (Harvey). Our findings suggest that the value depends on the context, which is apparent from the various figures provided by our respondents, wherein those working in businesses with high value contracts consider a CZK5000 lunch as a normal instance while those in lower value businesses suggest amounts between CZK500 and CZK1000. Table 2 provides an overview of the different amounts suggested by our respondents.

The factor of (ii) **'timing, intention and beneficiary matter the most'** builds on the value and character of a gift, and extends it in terms of determining *when?*, *why?* and *to whom?* a gift can be given. In terms of the timing, i.e. **when?**, our findings send a clear message - it is never good to give a 'gift' to someone who is a decision maker prior to a decision has been made; the answer to **why?** is too relatively straightforward, wherein all our respondents say that a 'thank you' or a show of appreciation and gratitude is a clear sign of a gift: e.g. *"if someone gives me a bottle then he would come after I have already done something for him"* (Harvey); *"[it was not corruption because] they have already had some cooperation"* (Irma); *"we have a very long-term contract with them, it's not that they want anything extra ... to strengthen the already existing relationships"* (Fiona); *"it has to be[!] our [existing] customer ... it shouldn't be a box of J.D. [whiskey] before the sales person gives him an offer"* (Don) or *"[it's a gift] if you are not taming the person ... [also t]here is a difference in timing"* (Leslie). The views on **to whom?** has been perhaps best expressed by Emily, who says that *"the more expensive and directed towards an individual or a narrow group of people the closer it gets to corruption"*. We find that a gift is not considered a bribe where the whole team benefits; however, should it be just a single-person beneficiary, it would be considered a problem. Before we present our third theme, which is linked to the context of gifting or bribing, the findings pertaining to the concept of a gift and a bribe threshold can be concluded in Fiona's own words: *"[t]o sum up, it is about the intention, the objectivity and also the appropriateness [both financial and nature of gift] ... if you have a 10 year contract, you need to know thoroughly [what you are getting into, so some expensive facility tours are ok] but you wouldn't go to the U.S. just to check something in a deal for a few bucks"*.

In addition to the concept of the gift-bribe threshold, we have observed another recurring theme - (iii) **'gifts in the public vs private sector'** - which is linked to the context of the gift/bribe occurrence. There appears to be great difference in the views regarding the line between a gift and a bribe in the public and the private sectors. This was explicitly expressed by some of our respondents who suggested that the rules for the public sector should be much tougher. We provide a quote from Gert that demonstrates this best: *"you have to distinguish between the public and the private sector ... if someone would want to give a car as a gift in the private sector, that's their business and I don't see it as corruption ... in the public sector, I would see anything other than the chocolates over CZK1000 and I would be very strict there [seriously said] because [public sector] influences the lives of all of us"*. Gert's view is representative of the viewed difference in the perceived gift-bribe threshold with our respondents allowing varying levels of liberties to the public sector, depending on their personal corruption tolerance. Table 2 provides an overview of what each of our respondents considered to be an acceptable gift in terms of its nature and value in public and private sectors.

Table 2: Gift Nature and Value by Sector

	PRIVATE SECTOR	PUBLIC SECTOR
Andrew	Gift CZK 500 - 1,000	Chocolate, coffee, flower
Barbara	Small gift, wine for Christmas	Coffee, chocolate
Cindy	Wine for Christmas, CZK 5,000	Not sure about limit
Don	Bottle for Christmas, CZK 1,000	Coffee, chocolate, bottle
Emily	Gift CZK 2,000 - 3,000	Gift CZK 1,000 - 2,000
Fiona	Gift up to CZK 5,000	Gift up to CZK 5,000 acceptable
Gert	No limit - expensive care still ok	Gift up to CZK 5,000
Harvey	Gift up to CZK 20,000	CZK5,000
Irma	Flower, bottle, chocolate	Chocolate, flower
Jose	CZK50,000	CZK50,000
Kirk	Catering, fridge, microwave	CZK 5,000 acceptable
Leslie	Bottle for Christmas, CZK 2,000	Gift, CZK5,000 acceptable

Source: Developed from interview data

Discussion

Our findings generate important answers to our research questions as well as a few interesting insights into corruption per se. Perhaps the most surprising outcome is the consensus of views of the corruption threshold and the reasoning underlying the determination of a gift-bribe threshold. Such a unified view clashed with the academic dispute as to what corruption is and that different people understand it differently as proposed by Bardhan (2006) or observed by Gordon and Miyake (2001). There are, however, differences in the value of a gift which individuals deem acceptable, of which some, despite the general consistency in the reported acceptable value, are relatively great. Such a result can perhaps be best explained by differences in individuals' corruption tolerance or moral sensitivity (Jordan, 2007). In addition to this outcome, the reflection of the conceptuality and context-specificity of the phenomenon in the understanding of it, as well as the reasoning behind the determining of the gift-bribe threshold is an important result. It is valuable in that it signifies two possible phenomena: first, it points to corruption being a phenomenon of which the definition needs to contain both the concept and the context based information, with the underlying theory of the concept holding across different contexts; and secondly, it suggests that the understanding of corruption and its workings endogenises context, thereby creating different standards and expectations for/from different actors and environments.

Whilst the issue of content vs context is not entirely novel to the corruption literature, the endogenisation of context within our definition of corruption is crucial and has potentially serious implications for legislators and practitioners who need to take these into consideration to design effective regulations and set appropriate codes of conduct which would curb corruption without hindering the development of cooperative relations in sectors that might not meet the criteria set by the law, in gift cultures in particular.

Similarly, the finding of a zero tolerance for cash clashes with the practice of putting a simple price tag on corruption as the means of regulating it. Our findings related to the value and appropriateness of a gift, however, highlight the difficulty in further determining a unified threshold. This is due to the importance role of subjectivity which is an obstacle highlighted in some of the studies which tested corruption sensitivity (Pitt and Abratt, 1986). The issue is, in addition to the subjectivity of views, the issue of context-specificity which the literature struggles to pin down (Lambsdorff, 2007; Roman and Miller, 2013).

Unlike the issue of the appropriateness and value related threshold for a gift and a bribe, the views on the timing of the gift-giving seem unified across our sample, which is the same result that Pitt and Abratt (1986) found in their study of corruption acceptability in a study with managers. Similarly, the beneficiary of a gift/bribe is something we hear very often from our respondents; this view is most likely embedded in the idea that a bribe is enveloped in secrecy and conditioned by happenings behind a closed door which is not satisfied in case the entire team benefits from such a gift, regardless of its value (Bardhan, 2006; Dormaels, 2015). In view of the understanding of these conditions for corruption, we often heard, during our fieldwork, of practices which firms use to internalise such gifts in their business operations and accounting in order to overcome issues they might face on the basis of corruption regulations which are often presented in the form of putting a price tag on the gifts which are exchanged in the said context.

The regulation of the value of gifts in the context of the public sector as well as the lack of regulation related to gifting in the context of the private sector seems appropriate. Our findings do not indicate what the exact value should be but they highlight the importance of considering the environment and context when regulating the gift-bribe threshold. Whilst setting the value of a gift might be a relatively easy task in the public sector, the private sector might find this more challenging due to the varying values of contracts and degrees of intimacy in business partnerships. We do not suggest that businesses leave the decision related to gifting solely to the liberty of their employees, but it seems appropriate that they provide training for their employees related to this issue where the issues identified in our study will be highlighted, which is also the practice recommended by scholars (Gordon and Miyake, 2001) and professional agencies concerned with combating corruption. Additionally, substituting the value - or better still complementing it - with the conditions identified in our analysis, most importantly the timing, beneficiary and intention, might be a way towards amending gifting and bribery beyond the common price tag approach. Given the differences in individual views related to the value of the gift-bribe threshold, it seems appropriate to recommend that, rather than relying on simple corruption awareness tests, businesses might adopt strategies allowing them to clarify these issues on an individual basis, allowing for the alignment of all their employees with the organisational views pertaining to this issue.

Conclusion

In this paper, we aimed to provide the answers to what counts as corruption and at what point does a gift become a bribe from the point of view of Czech managers. Using a qualitative research approach, we discussed these questions with 12 managers in the Czech Republic in semi-structured interviews. These discussions yielded some results which are in line with the extant corruption literature as well as some results which

contradict it. There is one outcome of our inquiry which we would like to highlight in particular as it has implications for both theory and practice - the role of subjectivity and context as a concept. Most of the implications and possible implementation for firms and regulators have already been discussed above. Despite the similarities of our findings with the wider corruption literature, we need to emphasise that ours is a small-scale qualitative study; the results of which would benefit from comparison with the findings of similar studies conducted across different contexts. Possible diversions from the mainstream corruption literature and similarities and differences between different contexts might point us towards alleys within the field which are yet to be explored.

There is, however, an additional implication that the role of a context and that of subjectivity has for our measurement and understanding of corruption around the world. Since all the indicators of corruption around the world - regardless of the agency providing them - rely on perceptions, it is crucial to bear in mind that they are prone to bias due to the differences in individual-level understanding of corruption as well as the context in which respondents operate. Given the important role such indexes play in decision making at various levels, future research should pay attention to this issue and explore ways of either utilising or overcoming such individual and context related variations in corruption perceptions in designing and producing these corruption indicators.

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Living Standard in OECD Member Countries

Abstract

The research database for the present paper consists of the OECD countries (except Turkey and Lithuania). The primary objective of the study is to group the countries according to twelve variables – average wage, minimum wage, GDP per capita, rates of unemployment, exchange and inflation rates, income tax, GDP per hour worked, indices of industrial, construction and manufacturing production and retail trade index, determining which of them significantly affect the average wage and defining the type and strength of such a relationship. The average wage, minimum wage and GDP per capita are used after their conversion into purchasing power parity, allowing for the comparison of price levels and PPP in different countries. Another important aim is to develop forecasts of the wage level for OECD countries by 2020. With regard to the countries' clustering according to the above criteria, Czechia always ranks alongside other post-communist countries (except Slovenia). The only explanatory variables affecting the average wage significantly are GDP per capita, income tax and manufacturing and retail trade indices, GDP exerting a major influence. Simple regression analysis of the dependence between the average wage and GDP per capita indicates that its course is best captured by the concave parabola with the peak at 77,252 PPP USD. The selected second-order polynomial regression explains approx. 89 percent of the variability of the observed values of the average annual wage. Wage growth by 2020 is expected in virtually all the OECD countries.

Key Words

OECD member countries, average annual wage, GDP per capita, cluster analysis, regression hyperplane

JEL Classification: E24, J31, C38, C51, C53

Introduction

All member countries of the Organization for Economic Cooperation and Development (OECD) are economically advanced. There are, however, large differences in terms of standards of living, as evidenced, inter alia, by the average gross wage. Wage growth is based on the degree of personal and economic freedom, optimal business conditions, functioning public administration and an advanced education system that produces qualified graduates. Successful businesses stimulate labour market demand, skilled employees thus enjoying better job opportunities.

The database for the present research consists of the OECD countries (excluding Turkey and Lithuania because of insufficient data). Table 1 gives an overview of the 34 member countries along with their two-letter codes defined in ISO 3166-1 alpha-2.

There are several research objectives that have been pursued. OECD member states were grouped into clusters of countries that are as close as possible to each other in terms of the following twelve variables for the year 2016 – average wage (gross), minimum wage (real), per capita GDP (all the above in constant prices 2015 in USD after purchasing power parity (PPP) conversion), unemployment rate (in percentage terms), exchange rate (per USD, period average), inflation rate (annual CPI), income tax (pct. of labour costs for a childless person), GDP per hour worked, industry (industrial production index), construction (construction production index), manufacture (manufacturing production index) and retail trade (retail trade index); for all the above indices, 2010 = 100. The Dunn validation index being used to determine the optimal number of clusters, the OECD states were divided into seven groups. The Ward method with the Euclidean, squared Euclidean and city-block distances was employed for the construction of clusters. Using the Euclidean and city-block distance metrics, Czechia forms clusters together with five other post-communist countries, namely Estonia, Hungary, Latvia, Poland and Slovakia. Applying the squared Euclidean distance metric, Czechia constitutes a cluster along with the same countries plus Israel.

Tab. 1: OECD country codes (ISO 3166-1 alpha-2)

Code	Country	Code	Country	Code	Country
AU	Australia	FR	France	LV	Latvia
AT	Austria	GB	Great Britain	MX	Mexico
BE	Belgium	GR	Greece	NL	Netherlands
CA	Canada	HU	Hungary	NO	Norway
CH	Switzerland	IE	Ireland	NZ	New Zealand
CL	Chile	IL	Israel	PL	Poland
CZ	Czechia	IS	Iceland	PT	Portugal
DE	Germany	IT	Italy	SE	Sweden
DK	Denmark	JP	Japan	SI	Slovenia
EE	Estonia	KR	South Korea	SK	Slovakia
ES	Spain	LU	Luxembourg	US	United States
FI	Finland				

Source: <http://ec.europa.eu/eurostat>

There is no doubt that the development of the average wage is related to that of the gross domestic product and other relevant indicators such as income tax, total manufacturing production index and total retail trade index. In a period of GDP growth, the real wage growth is usually also expected. This, however, is not always the case, because GDP represents the total monetary value of goods and services provided over a given period in a particular country. Other factors, such as profit, interest rates and housing rents, come into play. Therefore, it is possible that GDP increases, but the average wage stagnates or even decreases – if, for instance, the profit has a larger share of GDP. Economic growth may also lead to an increase in the profits of companies which, however, do not share them with their employees. Many authors examine the link between wage behaviour and GDP and other labour market indicators. An obvious mismatch between per capita GDP development and real wages in pre-industrialized Europe is addressed, e.g. in Angeles (2008). It becomes apparent that the two indicators start to change if there are any changes to the three following factors – income distribution, labour supply per capita and relative prices. The relationship between GDP per capita and real wages in Australia and Great Britain in 1870–1992 was analysed by Oxley & Greasley (1997). Regarding the changes in GDP, the labour market adjustment mechanism was examined by Akkemik, (2007), the results indicating that the adjustments lag behind the growth of GDP.

An important goal of this paper is to investigate the dependence of the average wage on the other eleven variables for 2016, thus determining which of them statistically significantly affect the explained variable and indicating the type and strength of such a dependence. Normality of the variables was verified both visually and with the use of the Kolmogorov-Smirnov, Chi-Square and Shapiro-Wilks tests. Having employed simple correlation coefficients between the chosen explanatory variables, no problems with multicollinearity were identified. Inspecting visually and using the Glejser test, no heteroscedasticity was detected either. The suitability of the constructed model was verified by t- or general F- tests, determination coefficient and the Durbin-Watson test statistic. The regression hyperplane with eleven explanatory variables was considered in the first step. The methods of stepwise regression and forward selection were used to choose the appropriate set of explanatory variables (backward selection leading to the same selection of variables). It was found that only four explanatory variables – GDP per capita, income tax, manufacture and retail trade – statistically significantly affected the explained variable at a five percent significance level, GDP having the greatest impact. Therefore, a simple dependence of the average wage on per capita GDP was investigated. The concave regression parabola was chosen as the most appropriate model, allowing for the explanation – along with per capita GDP – of almost 89 percent of the variability of the average wage values observed.

Another important aim of this study was to make forecasts of the average wage for each country by the year 2020. The predictions were created analysing the relevant time series from 2000 to 2016. Exponential smoothing was used, appropriate exponential smoothing was selected using interpolation criteria. Sample residual autocorrelation and partial autocorrelation functions were used to find out, if the non-systematic component does not indicate autocorrelation. Durbin-Watson statistic was used to discover, if random failures can be therefore considered as independent. Model quality assessment was also performed using the Theil coefficient of non-compliance.

The price of providing labour, i.e. the wage rate, differs from prices of other factors of production because of the special nature of the workforce, whose position in the production process and behaviour in the labour market is determined by many (economic, social, political, cultural, educational) influences. The wage level and development is not just the outcome of economic output (measured by GDP) and labour market functioning, but also a basic determinant of the standard of living. The research database comes from the official OECD website.

Statgraphics and SAS statistical packets and the Microsoft Excel spreadsheet were used for data processing.

1. Methods of Research

Cluster analysis was used to divide the OECD member states into relatively homogeneous groups according to the 2016 data on the twelve variables mentioned above. Multidimensional observations can be applied when classifying objects into several relatively homogeneous clusters.

Fig. 1: Dendrogram of seven clusters (cluster analysis using Ward method and Euclidean distance)

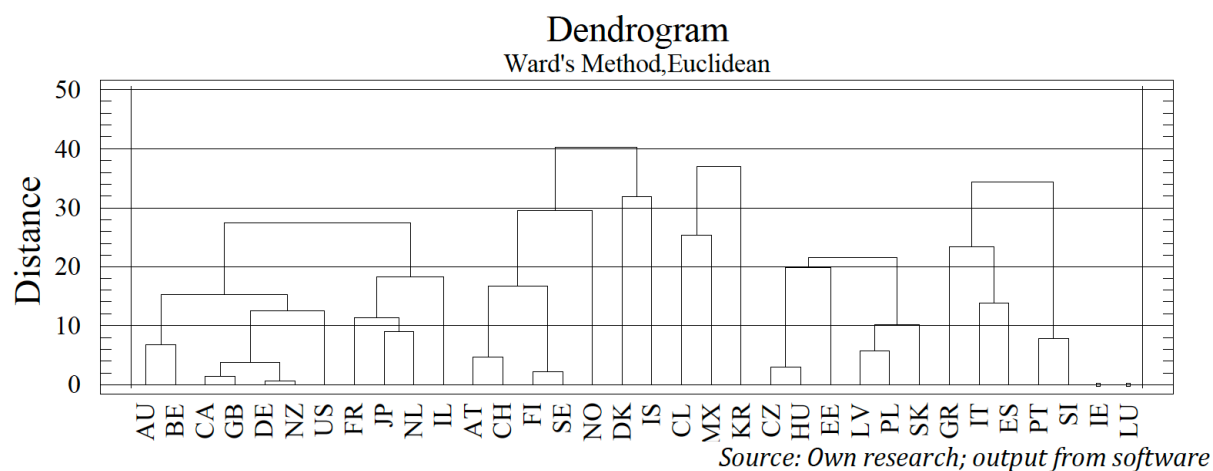


Fig. 2: Dendrogram of seven clusters (cluster analysis using Ward method and squared Euclidean distance)

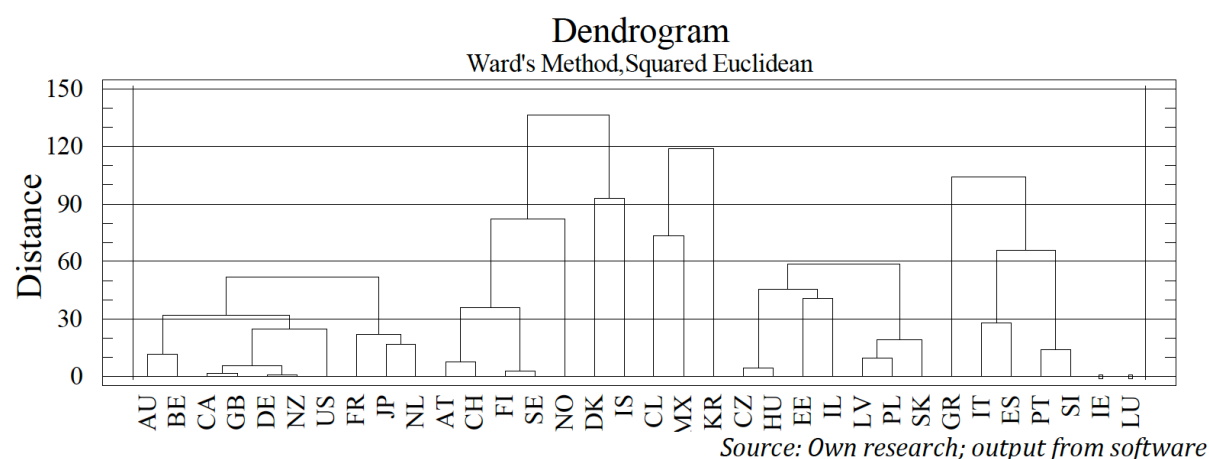
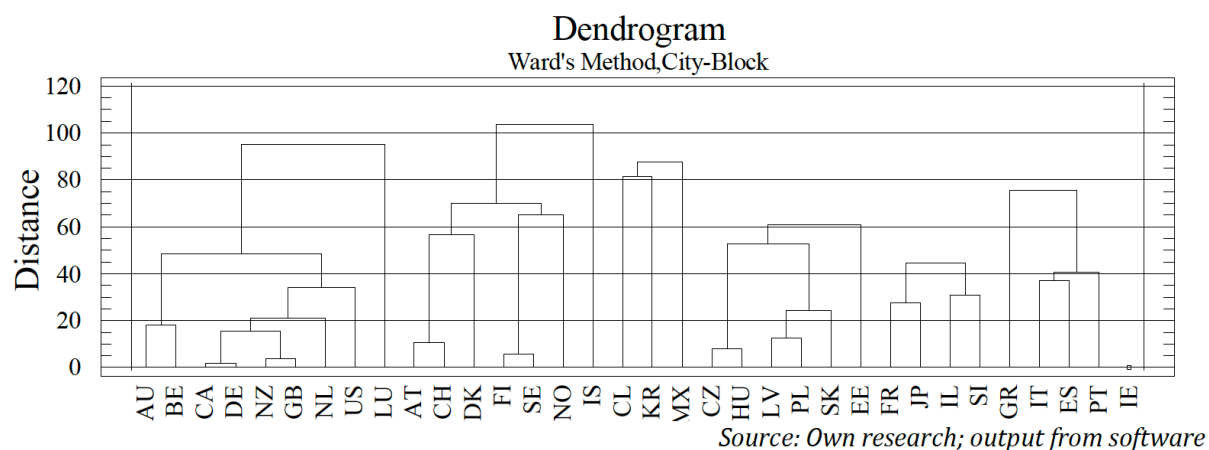


Fig. 3: Dendrogram of seven clusters (cluster analysis using Ward method and city-block distance)



We have a data matrix X of $n \times p$ type, where n is the number of objects and p the number of variables. Assuming various decompositions $S(k)$ of the set of n objects into k clusters, we look for the most appropriate ones. The aim is to identify the objects as

similar as possible to each other within each cluster that are at the same time most different from those in other clusters, only decompositions with disjunctive clusters and tasks with a specified number of clusters being allowed. Šimpach & Pechrová (2016).

The essence of this multidimensional statistical method is explained in detail in Rencher & Christensen (2012) or Šimpach & Pechrová (2016). In cluster analysis, there are different approaches and views on how to determine the optimal number of clusters, no definite conclusions being provided since cluster analysis is basically an exploratory method, not a statistical test. Commentary on and interpretation of the resulting hierarchical structure depends on the context, and theoretically there are often several possible solutions. Nevertheless, there are ways that help determine the optimal number of clusters, validation indices in particular. The proven Dunn index is one of them, representing the ratio of the smallest to the largest intra-cluster distance and taking values from zero to infinity; high index values indicating the optimal number of clusters. For example, the number of clusters is solved in Löster (2019) or Řezanková & Húsek (2007).

The Ward method tends to remove too small clusters, so there is a tendency to create clusters of approximately the same size, which is a desirable feature in terms of clustering of the OECD countries. This is why the Ward method was utilized in the present clustering analysis. Since there is no need to strengthen the influence of any variable that might have an impact on the sum of squared distances (the points with the same distance from the centre lying on a circle), the Euclidean distance was chosen. It was completed with the square Euclidean and Hemming (city-block) distance metrics, allowing for a comparison of the results obtained. Figures 1–3 represent dendrograms of seven clusters analysed using the Ward method, Euclidean, squared Euclidean and city-block distances.

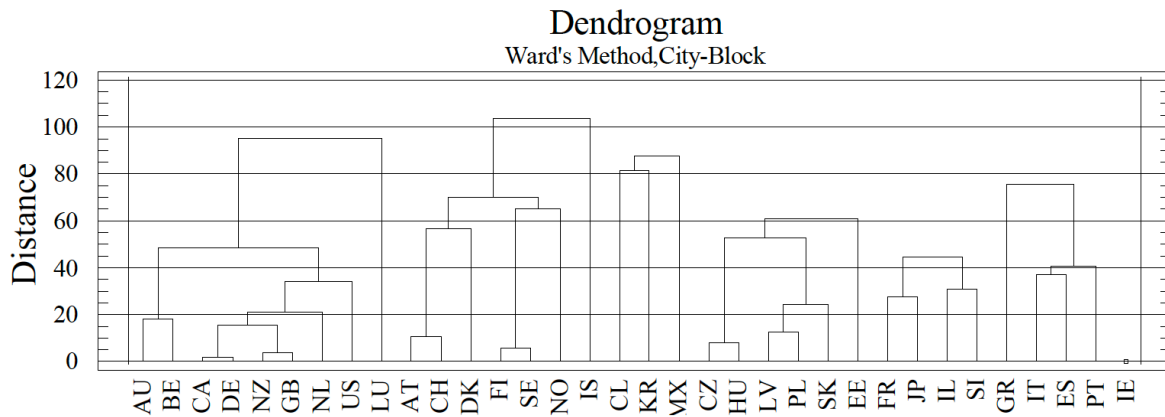
The regression and correlation analysis (cf., e.g. Darlington & Hayes (2017)) was carried out to examine data for the year 2016. The average wage represents an explained variable, the remaining eleven variables being explanatory ones. The normality of all variables was verified both visually and using Kolmogorov-Smirnov, Chi-Square and Shapiro-Wilks goodness-of-fit tests. Figure 4 and Table 2 illustrate the normality validation procedure for the average wage variable, which is then applied to the other eleven variables. Although the variable “wage” usually follows a lognormal distribution (with a positive skew), the “average wage” has a symmetrical distribution, which is an argument in favour of the normal distribution; see Figure 4. Considering the three goodness-of-fit tests, the smallest P-value is 0.0630961 for the Chi-Square test; see Table 2. This means that the null hypothesis, assuming the normality of the average wage distribution, cannot be rejected at a five percent level of significance.

Tab. 2: Average wage normality assessment using Kolmogorov-Smirnov, Chi-Square and Shapiro-Wilks goodness-of-fit tests

Kolmogorov-Smirnov goodness-of-fit test	
Statistic:	0.119269
P-value:	0.718792
Chi-Square goodness-of-fit test	
Statistic:	21.5294
P-value:	0.0630961
Shapiro-Wilks goodness-of-fit test	
Statistic:	0.950289
P-value:	0.15913

Source: Own research; output from software

Fig 4: Frequency histogram of average wage distribution normality (2016)



Source: Own research; output from software

When constructing a regression model, a regression hyperplane was considered in the first step. The so-called stepwise regression and then forward selection were used to determine a set of explanatory variables that have a statistically significant effect on the explained variable (backward selection leading to the same results). Only four explanatory variables exert a statistically significant effect on the average wage at a five percent significance level. They are GDP per capita, income tax, manufacture and retail trade. All t-tests and the general F-test are statistically significant at a five percent level of significance, the multiple determination coefficient indicating that 86.48 percent of the variability of the observed average wages were explained by the selected regression hyperplane. The Durbin-Watson statistic value is 1.83808, thus being close to the value 2 (in the interval 1.6, 2.4). This means that autocorrelation does not pose any problem. The nature of corresponding residues can be considered as accidental and so satisfactory. Apart from the visual assessment, the Glejser test was conducted, showing no heteroscedasticity present. For these reasons, we can see the selected regression hyperplane with four explanatory variables as satisfactory. Matrix of simple correlation coefficients between the explanatory variables shows that none of these correlation coefficients' absolute values is higher than 0.5. Thus, harmful multicollinearity does not

occur between the explanatory variables. The resulting regression hyperplane has the form

$$\text{Average\_wage} = 7956.69 + 0.778627 * \text{GDP\_per\_capita} + 404.909 * \text{Income\_tax} - 183.614 * \text{Manufacture} + 154.08 * \text{Retail\_trade}.$$

Since GDP per capita was the first explanatory variable inserted into the model, we will still deal with a simple regression analysis of the dependence of the average wage on GDP per capita. Eventually we compared the results of a simple linear and quadratic regression analysis.

All t-tests and general F-tests are statistically significant at a five percent significance level and the Durbin-Watson statistic is near the value 2 for both regression dependencies, i.e. in the interval (1.6, 2.4). The adjusted determination index of the regression line is 74.89 percent, while that of the regression parabola reaches 87.82 percent. In the case of a linear regression function, residues follow a non-random pattern. Regarding quadratic regression, the character of residues can be considered random and therefore satisfactory. In addition to the visual assessment, the Glejser test was carried out, proving the absence of heteroscedasticity. Therefore, the second-order polynomial regression function can be considered as a more appropriate model of the average wage dependence on GDP per capita. The regression parabola is in the form

$$\text{Average\_wage} = -19286.0 + 2.13272 * \text{GDP\_per\_capita} - 0.0000138036 * \text{GDP\_per\_capita}^2.$$

Exponential smoothing was used, the statistical software automatically evaluating the best combinations of equalizing constants. (The advantage of exponential smoothing lies in the fact that the latest observations are the most significant.) Appropriate exponential smoothing was selected using interpolation criteria. In all cases, sample residual autocorrelation and partial autocorrelation functions show that the non-systematic component does not indicate autocorrelation. Values of the Durbin-Watson statistic are close to the value 2 in all cases. Random failures can be therefore considered as independent. Model quality assessment was also performed using the Theil coefficient of non-compliance. The essence of time series analysis is described in detail in Brockwell & Davis (2002).

2. Results of the Research

The OECD brings together countries with the most advanced economies which produce more than two-thirds of the world's goods and services, meeting the challenges of economic globalization. Therefore, the grouping of OECD countries by selected economic indicators, using the three distance matrices, offers useful insights. The Dunn validation index determines seven clusters.

The above mentioned grouping makes it possible to compare clusters of countries that regularly constitute a common group within the classification. The Euclidean, squared Euclidean and city-block distances are used along with the so-called Human Development Index that measures and compares key dimensions of the quality of life indicating the standard of living.

The most advanced countries such as Australia, Belgium, Canada, Germany, the Netherlands, New Zealand, Great Britain and the United States always appear in the same group according to the twelve variables analysed. Scandinavian and other highly developed European countries (Austria, Switzerland and Iceland) create another cluster. A separate group consists of three non-European countries, namely Chile, South Korea and Mexico. The Czech Republic is always part of a group of other post-communist countries except the more advanced Slovenia. South European countries facing economic problems in recent years constitute another group. Ireland, having also experienced a debt crisis, and Luxembourg always form “groups” of their own. The position of the latter is exceptional, its high GDP and, consequently, the level of wages relating to the small size of the country and the fact that about a third of the labour force commutes for work to Luxembourg from the neighbouring countries, thus not being included in the total population.

Only four out of the eleven explanatory variables considered (GDP per capita, income tax, manufacture and retail trade) affect significantly the explained variable (average wage) at a five percent significance level – three of them positively and one (manufacture) in a negative way. Sample regression coefficients indicate the change in the average wage if the value of the corresponding explanatory variable increases by one unit, provided the values of the other explanatory variables remain unchanged.

Tab. 3: Average wage prediction for selected countries from each cluster

Year	Country						
	United States	Norway	Mexico	Czechia	Slovenia	Ireland	Luxembourg
2017	60,207	54,143	15,423	24,019	35,776	51,411	63,042
2018	60,678	54,642	15,504	24,527	36,587	51,732	63,502
2019	61,150	55,142	15,585	25,035	37,398	52,053	63,963
2020	61,622	55,641	15,665	25,543	38,210	52,375	64,423

Source: Own research

Regarding the predictions of the average wage, Table 3 provides the predicted values for the seven selected countries representing each cluster. It is clear from the table that we can expect a marked rise in Slovenia and the countries of the same cluster by 2020. Only gradual wage growth is likely to appear in other OECD countries, especially in Central and South America and South Korea. Wage level decline is not predicted in any OECD member country over the next three years.

Conclusion

In terms of the twelve variables considered, Luxembourg and Ireland have a unique position. The former country (a small inland one, contrary to the latter) reports the highest annual PPP-based GDP per capita. The reason is that about a third of the workforce consists of foreign nationals commuting from neighbouring countries who are not included in the total population of Luxembourg. The cluster analysis shows that Czechia is always grouped along with other post-communist OECD countries, except for Slovenia. Greece and Spain, for example, are clustered together in groups of countries encountering economic difficulties. The analysis shows that a gradual, mostly modest

increase in the average annual wage in almost all OECD countries can be expected by 2020. This is in line with OECD economic forecasts. Trade and private investment extension has restarted job creation and inflation will grow only slightly. However, new tensions and threats may derail the

recovery. The economic outlook highlights a range of policies that can help maintain medium-term growth and ensure that its benefits are widely shared. Wage growth is expected to support household consumption, relatively low interest rates allowing for further capital investment. Overall economic growth will also alleviate the labour shortage.

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Nominal Convergence in the New EU Member States: Comparative Analysis

Abstract

The article deals with nominal convergence in the new member states of the European Union. Nominal convergence is quite frequent topic, however, there is no uniform definition and therefore, its development can be researched through many approaches. Although the Maastricht Criteria express the official attitude of the European Union to nominal convergence, a large number of economists research this economic phenomenon through price levels in a narrow concept or through all nominal variables in a broader concept. The article analyses nominal convergence in the European Union in a narrow concept through researching comparative price levels. It focuses on ten new member states that joined the EU in 2004. Within this group of states, seven of them have already accepted the euro and are members of the eurozone, while the rest is still using their own national currencies. The aim of the article is to find out whether there is a different development of the nominal convergence in states using euro compared to development in states using their own currencies. The development of comparative price levels, the main indicator of the nominal convergence in a narrow concept, is analysed based on data from 2006 to 2017 through regression analysis and a coefficient of variation.

Key Words

nominal convergence, real convergence, price convergence, comparative price level

JEL Classification: E31, F15, O11

Introduction

The original aim of creating the European Union was to decrease inequalities between countries with different economic levels. European integration and EU enlargement is connected with process of convergence. In general, the convergence means approaching to the same level of certain indicator. That means differences between variables decrease during observed period. Economic theory distinguish between real and nominal convergence. Both convergences are observed and analyzed by different approaches and indicators and there is no uniform definition of them. In general, the real convergence means the catching up process, in which economic levels of different countries converge to the same level. The most common indicator to measure real convergence is the gross domestic product per capita. The nominal convergence focuses on nominal variables. Compared to real convergence, there are more approaches and authors use a large number of different indicators as mentioned below. An independent subject of importance is the relationship between real and nominal convergence, because both concepts of convergence interact. Usually, countries with low economic levels have low price levels. As economic level grows, price level grows too and vice versa. In this paper, the attention is given to the nominal convergence and the aim is to find out whether the

process of nominal convergence in selected EU member states but eurozone non-member states differs from the process of nominal convergence in selected eurozone member states. In the comparative analysis, Czechia, Poland and Hungary are compared with Slovenia, Cyprus, Malta, Slovakia, Estonia, Latvia and Lithuania. All these states entered into the European Union together in the year 2004, but first three mentioned have not adopted the euro yet. Attention is not given to reasons why these states are not the eurozone member states, but whether or not there is different development in context of nominal convergence.

1. Literature Review

Economists have been interested in convergence for many decades and this economic and econometric topic has become a question under debate of mainstream macroeconomic theorists and econometricians, which was caused by the fact that convergence across economies was proposed as the main way to test the validity of modern theories of economic growth. Since the late 90s, various publications devoted to real and nominal convergence in context of EU enlargement.

The real convergence expresses process when economic levels of different countries converge to the same level. There are more concepts of real convergence. Authors of studies often examine the real convergence through concepts of β -convergence and σ -convergence. These concepts were set by Sala-i-Martin (1995) and result from neoclassical theory of economic growth. The β -convergence is defined as a situation, when economic growth is higher in poorer countries than in richer countries. The σ -convergence is defined as a situation, when the dispersion of real capita GDP levels tends to decrease over time. Another approach describes this problem more alternatively due to the invitation process (Petříček, 2015).

The nominal convergence of the EU countries can be also analysed by more approaches. The term “nominal convergence” isn’t unified and authors use different indicators to analyse it. Generally, the nominal convergence means approaching of nominal variables. The narrow concept analyzes the nominal convergence through the convergence of prices, i.e. price levels. The broader concept comprises all nominal variables such as prices, nominal wages, rents. The official approach of the EU to the nominal convergence are the Maastricht criteria called convergence criteria.

Ždárek (2006) published the working paper “Nominal Convergence in the Czech Republic - Selected Aspects and Implications”, where nominal convergence is observed through convergence of prices. Also Vintrová and Ždárek (2007), Vintrová and Spěvák (2010) and other authors (Alho, Kaitila and Widgrén, 2005; Drastichová, 2012) analyze nominal convergence through the price level, i.e. they focused on price convergence. The main reason and the argument why they prefer the price level is that the Maastricht criteria are based on marginal variables, which means they monitor the development of inflation, but not the initial price level. Therefore, in case the initial price level is different and the inflation rate is similar, it is impossible to achieve the same price levels and there wouldn't be any price convergence. Herrmann and Jochem (2003) observed the nominal convergence through the inflation differentials.

2. Methods of Research

However the Maastricht Criteria express the official attitude of the EU to nominal convergence, the analysis of price levels was selected in this paper as an approach for nominal convergence evaluation. The price level is measured by the comparative price level (CPL). CPL is defined as the ratio of purchasing power parity to market exchange rate.

$$CPL = \frac{\text{purchasing power parity (PPP)}}{\text{current nominal exchange rate}} \quad (1)$$

CPL expresses how much the same amount of goods and services in different countries costs. If the value of CPL is higher than 100, the price level in observed country is higher than in reference country, i.e. the country concerned is relatively expensive as compared to the one to which it is compared (a concrete country or the EU average). Comparative price level is the same as the price level index (PLI) measured by Eurostat.

Another indicator used to express nominal convergence is exchange rate deviation index (ERDI), that is defined as an reciprocal value of the CPL.

$$ERDI = \frac{1}{CPL} = \frac{\text{current nominal exchange rate}}{PPP} \quad (2)$$

The nominal convergence (or divergence) can be realized through two channels, the inflation rate channel and the nominal exchange rate channel.

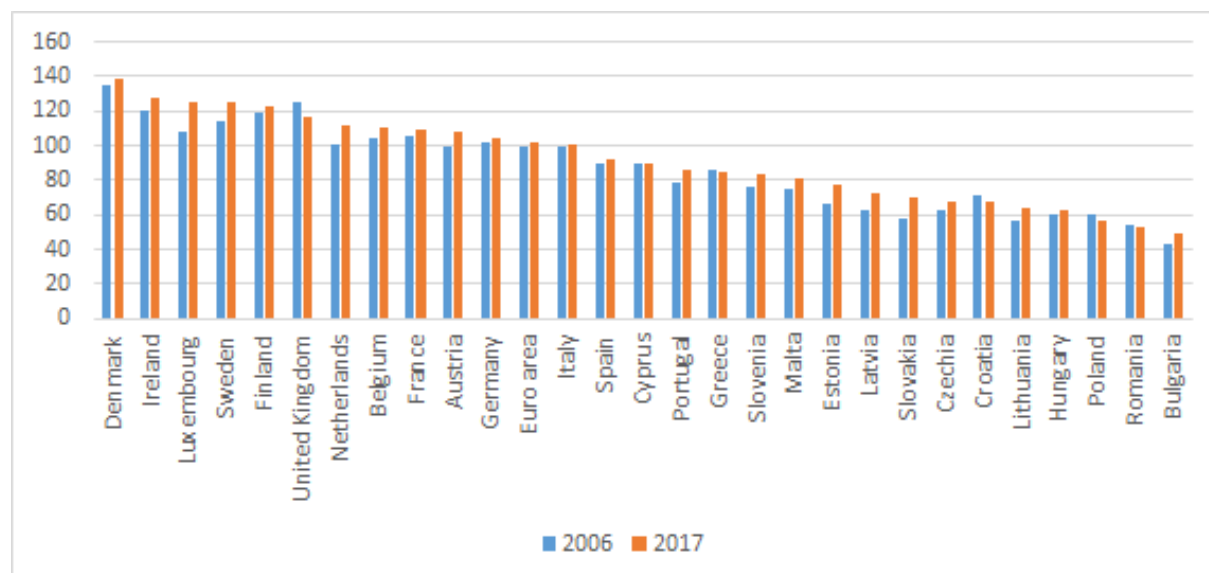
$$CPL_t = \chi_t + \pi_t \quad (3)$$

where χ_t is a change of nominal exchange rate and π_t is an inflation rate, both in period t . It depends on the monetary policy and exchange rate regime of the country, which channel outweighs. In case of fixed exchange rate regime, the changes in CPL occur only through the price channel. In case of the free floating exchange rate, both channels can be used. After the entry into eurozone, the exchange rate channel can not be used anymore and nominal convergence occurs only by the inflation rate channel. The inflation rate channel is influenced by structural changes in economy, changes of demand and supply, taxes adjustment etc. For countries with an inflation targeting régime, such as the Czech Republic, there exist the range of the inflation rate channel. The exchange rate channel is influenced mainly by fundamental factors (i.e. labor productivity development), but also by tranzitive factors.

Figure 1 shows comparative price levels in the EU for all member states, where EU-28 = 100. For better comparison, they are sorted from the highest to the lowest CPL in 2017. It is apparent from the figure that the highest comparative price levels are in Denmark, Ireland, Luxembourg, Sweden, Finland and United Kingdom. On the contrary, the lowest

comparative price levels are in Bulgaria, Romania, Poland, Hungary and Lithuania. The Czech Republic reached 68,2 % of the EU-28 in 2017 and it can be classified as a country with lower comparative price level.

Fig. 1: Comparative Price Levels in the EU in 2006 and 2017 (EU-28 = 100)



Source: authors' own elaborations, data from (Eurostat, 2019)

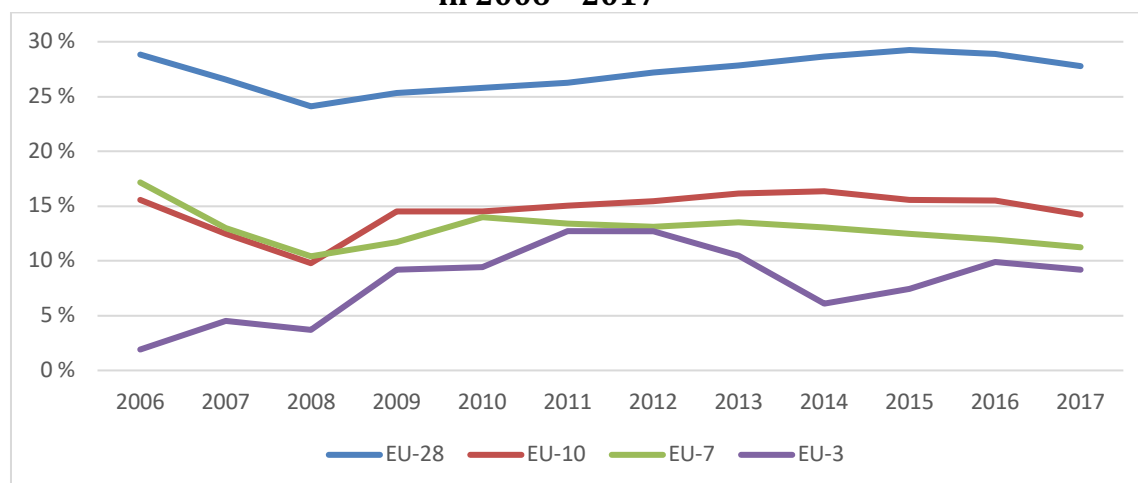
Comparative analysis of nominal convergence focuses on the new member states (EU-10) which joined at 2004. There are divided into two groups. The Czech Republic, Poland and Hungary, i.e. states that have not accepted euro yet are labelled as EU-3 and the rest of states who accepted the euro are labelled as EU-7. Slovenia accepted the euro in 2007, Cyprus and Malta in 2008, Slovakia in 2009, Estonia in 2011, Latvia in 2014 and finally Lithuania in 2015. The research should show, whether the process of nominal convergence in the EU-7 (eurozone members) differs from the process in the EU-3 (eurozone non-members). Regression analysis and development of coefficient of variation are used to analyse nominal convergence in these group of EU member states. In case of regression analysis, it is examined whether there is an increasing trend and therefore convergence. In case of development of coefficient of variation, a decreasing coefficient within a country group demonstrates convergence.

3. Results of the Research

To compare comparative price levels of EU-10, regression analysis was used, where a development of median calculated from comparative price levels of EU-3 and EU-7 for each year was analysed. For EU-3, equation of regression function is $Y(t) = 64,246 - 0,407 t$. P-value of the slope is 0,096, so there is no linear trend and nominal convergence through comparative price levels was not demonstrated. Detailed analysis of trend functions for each country from this group showed that the development of CPL of the Czech Republic and Hungary are without trend. The CPL of Poland shows a trend, but it is decreasing, which means that price level of Poland diverges from EU-28 price level.

For EU-7, equation of regression function is $Y(t) = 69,426 + 0,583 t$. P-value of the slope is 0,0106, so there is a linear trend and therefore, nominal convergence through comparative price levels was demonstrated for EU-7. Detailed analysis of trend functions for each country from this group showed that the development of CPL of most of observed countries were without trend. Only Estonia and Malta have increasing trend, i.e. they converge to EU-28. Using a regression analysis, the nominal convergence of the EU-7 toward EU-28 can be concluded while nominal convergence of the EU-3 cannot be concluded.

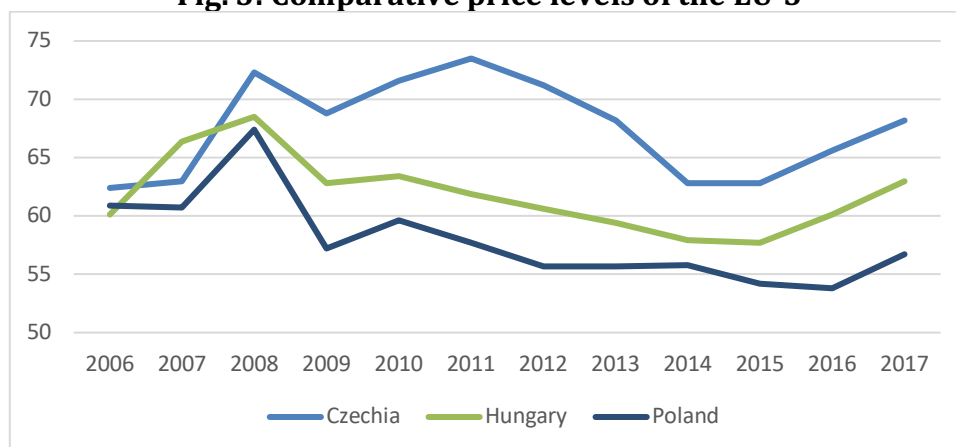
Fig. 2: Coefficient of variation within the EU-28, the EU-10, the EU-7 and the EU-3 in 2006 – 2017



Source: authors' own calculations, data from (Eurostat, 2019)

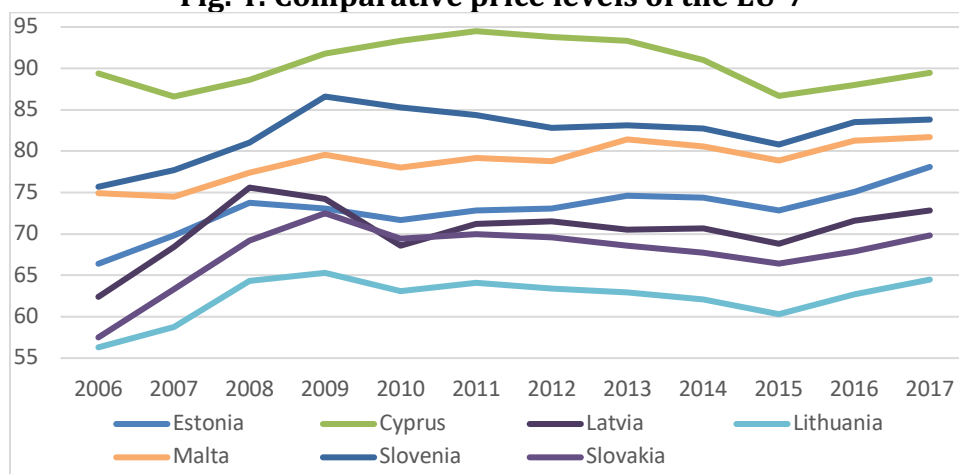
Another possibility to research nominal convergence is through a coefficient of variation. Figure 2 shows development of the coefficient of variation within the EU-28, the EU-10, the EU-7 and the EU-3. The coefficient of variation of the EU-28 did not change significantly during the observed period (from the value 28,81 % in 2006 to 27,78 % in 2017). Until 2008, the coefficient of variation was decreasing and therefore comparative price levels converged. The economic crisis changes the trend and comparative price levels diverged until 2015. From 2016, the coefficient of variation has slightly decreased. Within the EU-3, there are visible changes indicating that comparative price levels of Czechia, Hungary and Poland do not converge, they even diverge. The coefficient of variation of the EU-3 changed from the value 1,91 % in 2006 to 9,19 % in 2017. Within the EU-7, the development was also influenced by the economic crisis, but from 2010, the value is relatively stable. The coefficient of variation of the EU-7 changed from the value 17,16 % in 2006 to 11,24 % in 2017. We can conclude that within the EU-7, comparative price levels converge.

Fig. 3: Comparative price levels of the EU-3



Source: authors' own calculations, data from (Eurostat, 2019)

Fig. 4: Comparative price levels of the EU-7



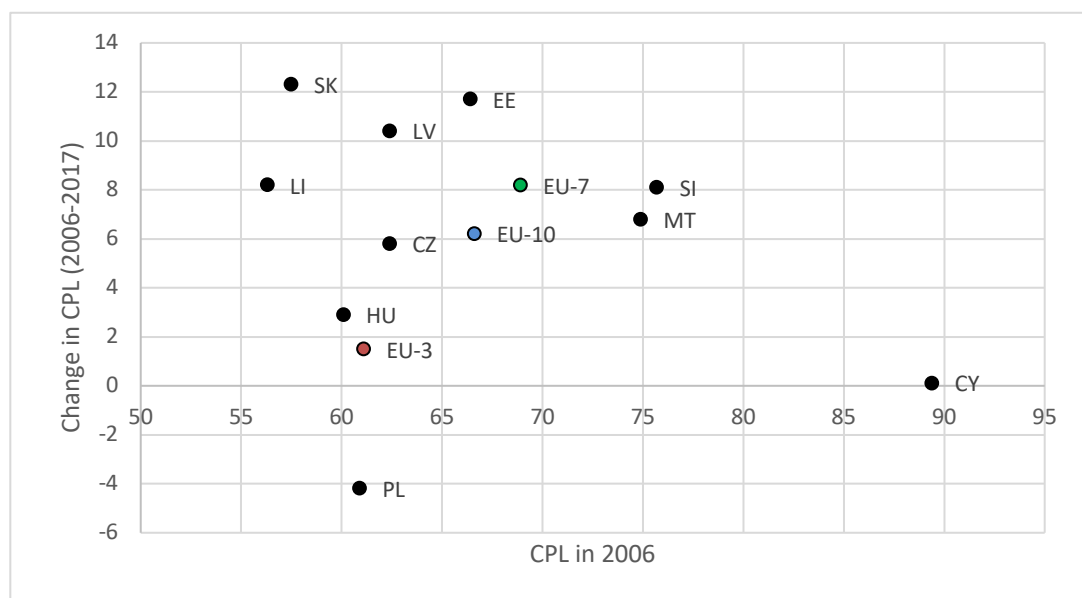
Source: authors' own calculations, data from (Eurostat, 2019)

Figure 3 shows the development of comparative price levels in the EU-3, i.e. in eurozone non-member states, while figure 4 shows the development of comparative price levels in the EU-7, i.e. in eurozone member states. From the EU-3, Czechia has nearly the whole observed period the highest comparative price level, therefore prices are higher than in Hungary and Poland and are closest to the EU average. In this figure 3, there is visible the reason why the coefficient of variation increased between 2008 and 2012 (see figure 2). Comparative price level in Czechia were relatively stable (the value of CPL was 72,3 in 2008 and 71,2 in 2012) while Hungary and Poland experienced a significant decline. In Hungary, the value of CPL was 68,5 in 2008 and 60,6 in 2012. In Poland, the value of CPL was 67,4 in 2008 and 55,7 in 2012. From the EU-7 (see figure 4), the highest comparative price level is in Cyprus (89,5 in 2017). Conversely, the lowest comparative price level is in Lithuania (64,5 in 2017). The development of comparative price levels within the EU-7 is very similar.

Figure 5 shows initial comparative price levels in 2006 and their changes between 2006 and 2017 in the EU-10. The situation of Cyprus is specific, because most of goods are imported and therefore, the initial level of the CPL is higher, almost on the level of EU-28.

The highest changes in the CPL were recorded in Slovakia (12,3 p.p.), Estonia (11,7 p.p) and Latvia (10,4 p.p.), while the lowest changes or even negative changes were recorded in Poland (-4,2 p.p.), Cyprus (0,1 p.p) and Hungary (2,9 p.p.). In comparison to the EU-3, the EU-7 had higher initial level and higher change of the CPL.

Fig. 5: The initial level and change in CPL in the EU-10 (EU-28 = 100)



Source: authors' own calculations, data from (Eurostat, 2019)

Conclusion

The aim of the article was to find out, whether there is a different development in the nominal convergence of the eurozone member states (EU-7) and the eurozone non-member states (EU-3). As mentioned, no official definition of the nominal convergence exists and authors use different approaches and indicators. Although the EU analyses the nominal convergence through the Maastricht criteria, most economists use different approaches and analyse the nominal convergence mainly through indicators of price levels. In this paper, attention is also paid to the price level measured through the comparative price level. The Czech Republic can be classified as a country with lower comparative price level (68,2 % of the EU-28 in 2017). According to the regression analysis of the comparative price levels of EU-7 and EU-3, the nominal convergence of the EU-7 towards the EU-28 can be concluded while nominal convergence of the EU-3 towards the EU-28 cannot be concluded. Within EU-7, only Estonia and Malta have increasing trend, therefore their comparative price levels converge to the EU-28. Within EU-3, only Poland showed a trend, but it is decreasing and therefore, the comparative price level of Poland diverge from the EU-28. Although during observed period, 2006 – 2017, the coefficient of variation of the EU-28 did record a change proving the nominal convergence, the change was not significant. The development of the coefficient of variation and therefore the development of the nominal convergence were influenced by the financial and economic crisis. Till 2008, the coefficient of variation was decreasing, while between 2008 and 2016, the coefficient of variation was increasing. In 2017, there is a slight decline and probably positive decreasing trend has started. To make a

comprehensive evaluation, it is necessary to analyse the channels of the nominal convergence and therefore, future research should aim at them.

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New Approach to Short-Term GDP Prediction: from Statistics to Fuzzy Model

Abstract

The inaccuracy of the predictions of the future growth rate of output is due to the lack of information needed to eliminate uncertainty. The aim of the paper is to predict the growth rate of the output within a short time period using the fuzzy approach, which is an appropriate tool for analyzing problems burdened by uncertainty. First, we briefly compare the fuzzy approach with the statistical methods in the cases where predictors face a non-deterministic environment. The principles of the fuzzy set theory is described and then applied in the gross domestic product growth rate prediction of Greece for the years 2018 (compared to the reported econometric forecast) and 2020 (a new contribution to the paper). The forecasts lean on the input components of the previous four-year development of three macroeconomic indicators (long-term interest rates, investments and unemployment) published in the OECD.stat, which are the basal input parameters of the task. The fuzzy prediction results showed no significant deviations from the statistical predictions. Nevertheless, the model input data monotonic development enabled us to demonstrate one of the ways by means of which the experts can correct the deficiencies of the fuzzy algorithm. Herein identified deficiency is the missing information originating from the input data, which the fuzzy algorithm did not work with. The appropriate corrective measure of the fuzzy model has been chosen and applied.

Key Words

short-term prediction, non-deterministic environment, fuzzy approach, expert knowledge

JEL Classification: E17, C53

Introduction to Uncertainty in Economic Predictions

The inaccuracy of the outcome of the prediction of the future growth rate of any state output is due to the lack of information needed to the complete elimination of uncertainty we face in every non-deterministic environment. This uncertainty is associated with both the inputs to the prediction model and its functioning. In the first case, we talk about “external” uncertainty stemming from the incomplete knowledge of the relevant values of *known* factors entering the prediction model (López-Duarte & Vidal-Suárez, 2010). They, together with the *unknown* values and therefore not considered factors in the model, influence the future growth rate of the output. In the latter case, we talk about the “inner” uncertainty stemming from the approximate character of the formal description of the considered relationships between inputs and outputs of the prediction model (Bloom, 2009). In each of these cases, we can encounter the uncertainty of two different kinds. The uncertainty in terms of randomness, whose *objectively identified* basic statistical characteristics are known, and uncertainty in the sense of “fuzziness”, which

predominantly derives from the vagueness of the terms (e.g., few, little, approximately, a little, essentially, simply, complexly, significantly, analogously, etc.) occurring in the description of the situation and indicating the *subjective understanding* of intuitive concepts.

Econometrics silently identifies uncertainty with randomness by considering the existing uncertain alternatives as equally probable in the context of the *indifference principle* (see Dubois, 2006) and building the prediction models solely on the basis of the probability theory and mathematical statistics (see e.g., Timmermans et al., 2017 or Vochozka et al., 2019). Observed data sets are represented by a system of impartial point estimates of selected characteristics (statistics) from which the predictive model derives a *statistically* expected value of the result. The sophisticated and complicated multiple regression algorithms help to extract as much information as possible from the available data.

However, a number of system theory authorities (see, for example, Zadeh, 1996) call into question the effectiveness of decision-making and management procedures based on the approximation of uncertainty with randomness. In terms of uncertainty, their works operate with the terms of *linguistic variables* formalized by *fuzzy sets* instead of the numerical values of *random variables*. Zadeh's work conception of terms as representatives of intuitive concepts is in line with Kahneman's conception of the functioning of the human mind (see Kahneman, 2003).

The aim of the paper is to present the fuzzy algorithm of the short-term prediction of the output growth rate operating under conditions of inner uncertainty and formulated within Zadeh's fuzzy approach offering *subjectively* expected values as an alternative to *statistically* expected values. It deals with the fuzzy algorithm of the progression of the time series, specified in the methodological part, which is preceded by a brief discussion of the basic principles of the fuzzy approach. In the application section, the fuzzy algorithm is used for the estimation of the GDP growth rate of Greece in 2018 (the comparison with the published econometric forecast) and 2020 (a contribution to the paper).

1. Methods of Research: the Fuzzy Approach

The *fuzzy approach* can be traced in different versions of fuzzy logic, which was formed by adapting the binary numerical characteristics of the proposition operators to the interval $\langle 0,1 \rangle$ (Hašková & Fiala, 2019). The fuzzy logic performs a tool for handling of fuzzy sets, the theory of which was published by Zadeh (1973).

1.1 Principles of the Fuzzy Set Theory

Let the set U be a field of consideration or discussion. Let $\mu_A: U \rightarrow \langle 0,1 \rangle$ be a membership function and let $\underline{A} = \{(y, \mu_A(y)): y \in U\}$ be a set of all pairs $(y, \mu_A(y))$ in which the numbers $0 \leq \mu_A(y) \leq 1$ assign to the given $y \in U$ a membership degree of the pair $(y, \mu_A(y))$ to the set $\underline{A}$. Then $\underline{A}$ is a *fuzzy subset* on the universe U . The significant characteristic of fuzzy subset $\underline{A}$ is its support $U_{\underline{A}} = \{y: 0 < \mu_A(y) \leq 1, y \in U\} \subset U$. In terms of fuzzy logic $\mu_A(y) = |y \in U_{\underline{A}}|$.

The element $y \in U$ with $\mu_A(y) = 0.5$ is called the *crossover point* in A . In the case of values greater than 0.5, the element y rather belongs to U_A , in the case of the smaller ones it rather does not belong to it (Dubois & Prade, 1996).

In this paper, the numerical fuzzy sets are formal representations of terms of linguistic variables. For our purpose, the model with one internal and two border fuzzy sets for the terms *low* (L), *common* (M), and *high* (H) value is suitable. Interval U is divided with the points a, b, c, d into five sections with the following membership functions (1):

$$\begin{aligned}
 (L) \quad & \mu_L(y) = 1 \text{ for } y < a, \\
 & \mu_L(y) = (b - y) / (b - a) \text{ for } a \leq y < b, \\
 & \mu_L(y) = 0 \text{ otherwise.} \\
 (M) \quad & \mu_M(y) = (y - a) / (b - a) \text{ for } a \leq y < b, \\
 & \mu_M(y) = 1 \text{ for } b \leq y < c, \\
 & \mu_M(y) = (d - y) / (d - c) \text{ for } c \leq y < d, \\
 & \mu_M(y) = 0 \text{ otherwise.} \\
 (H) \quad & \mu_H(y) = 0 \text{ for } y < c, \\
 & \mu_H(y) = (y - c) / (d - c) \text{ for } c \leq y < d, \\
 & \mu_H(y) = 1 \text{ otherwise.}
 \end{aligned} \tag{1}$$

The expert determines the position of the points a, b, c and d in the universe U . In the case of their regular distribution, we get the courses of the functions μ shown in Figure 1 in section 2. From it we see that the linguistic variable acquires the values at two levels: at the level of the basal values y in the universe U and at the level of terms (intuitive concepts) as fuzzy subsets of L, M, H in the universe U . Each of these terms is defined by its membership function μ_L, μ_M, μ_H over the field of its support, which is a subset of U .

Another important tool of the fuzzy set theory is the *rule*. In our considered model with n input linguistic variables and one output linguistic variable it is an element $((A_1, \dots, A_n), C)$ of the relation $F \subset (\{L_1, M_1, H_1\} \times \dots \times \{L_n, M_n, H_n\}) \times \{L, M, H\}$, which is a projection $F: (\{L_1, M_1, H_1\} \times \dots \times \{L_n, M_n, H_n\}) \rightarrow \{L, M, H\}$ in the form of $F(A_1, \dots, A_n) = C$, where $C \in \{L, M, H\}$ and $A_i \in \{L_i, M_i, H_i\}$, $i = 1, \dots, n$. The n -tuple of terms $(A_1, \dots, A_n)$ is the left side of the rule, the term $F(A_1, \dots, A_n)$ is the right side of the rule. The relation F has a maximum of n^3 elements. We call it a set of *inferential rules* (Běhounek & Cintula, 2006).

One of the basic concepts of the fuzzy set theory is the so-called extension principle (in detail see Kahraman, 2008). Our modification of the extension principle is based on the following steps:

1. *Fuzzification* in which the input vector $x = (x_1, \dots, x_n)$ converts each inference rule from the set P into the *logical* notation mode.
2. *A set of partial results* is a set $B = \{\min\{\min\{\mu_1(x_1), \dots, \mu_n(x_n)\}, \mu_B\}: (\min\{\mu_1(x_1), \dots, \mu_n(x_n)\}, \mu_B) \in P^*\}$.
3. *Aggregation* or summation of functions of set B into a compact unit and its aggregate μ_{agg} detection; this compact unit is a fuzzy subset on the universe V with $\mu_{agg} = \max\{\min\{\min\{\mu_1(x_1), \dots, \mu_n(x_n)\}, \mu_B\}: (\min\{\mu_1(x_1), \dots, \mu_n(x_n)\}, \mu_B) \in P^*\}$.
4. *Defuzzification*, which transforms the result from the level of terms (the function $\mu_{AGG}(y)$ of the fuzzy set AGG) into $y_0 \in Y$ in the space of basal values of the output

linguistic variable. We ascertain the basal value y_0 as the horizontal coordinate of the center of gravity of the area under the course of the function $\mu_{AGG}(y)$. Thus:

$$y_0 = \int y \cdot \mu_{AGG}(y) dy / \int \mu_{AGG}(y) dy \quad (2)$$

where $\int$ is the symbol of a certain integral over the universe Y .

Since the resulting constant y_0 is largely the result of the subjective experience and opinions of experts who created the model, we call it a *subjectively* expected value.

1.2 Task Assumptions and Input Data

The formulation of the fuzzy prediction model of the next time series member has its own specificity consisting of the fact that previous members of the resulting series are known (the historically measured values). Specifically, in the case of the GDP growth prediction it is possible to estimate the phase of the current GDP development (decline, depression, growth, stable boom, etc.). We also know the previous part of the baseline values of several linguistic variables, on which GDP depends (albeit, largely vaguely). This is reflected in the values of the extreme limits within which we look for the result of the prediction.

Table 1 lists the baseline values of LTI (long-term interest rate), INV (percentage increase in investment), UNE (percentage of unemployment) and the output linguistic variable $\Delta GDP\%$ (the GDP growth rate) of Greece between the years 2010 and 2017 and their econometric forecasts in 2018 and 2019 (the color-highlighted columns in Tab. 1).

Tab.1: Input macroeconomic data for the fuzzy prediction model of GDP growth rate in Greece

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
LTI	9.1	15.7	22.5	10.1	6.9	9.7	8.4	6.1	5.3	5.1
INV	-19.3	-20.5	-23.5	-8.4	-4.7	-0.3	1.6	3.3	7.2	7.5
UNE	12.7	17.9	24.4	27.5	26.5	24.9	23.5	21.5	20.1	18.4
$\Delta GDP\%$	-5.5	-9.1	-7.3	-3.2	0.7	-0.3	-0.2	1.4	2.3	2

Source: OECD Data: Gross domestic product (GDP), 2018; Investment (GFCF), 2018; Long-term interest rates, 2018; Unemployment rate Total, 2018 – own processing

The opinion of a knowledgeable expert is an important specificity of the fuzzy model formulation; the expert takes his/her knowledge and experience into account through qualified interventions in the model structure and the inference rule formulation.

The model works with the *dimensionless* basal values of the output universe Y and the input universes U_{LTI} , U_{INV} , U_{UNE} located within the interval $\langle 0, 100 \rangle$ and obtained by *converting the given basal values* of the respective linguistic variables. The conversion of the inserted basal value x of the universe of the *output* linguistic variable to the dimensionless value $y \in Y$ is given by the formula $y = 100 \cdot (x - x_{min}) / (x_{max} - x_{min})$, where x_{max} , or respectively, x_{min} is the highest, or respectively, the lowest a priori (subjectively) expected result value. For the conversion in the opposite direction $x = (y \cdot (x_{max} - x_{min}) / 100) + x_{min}$ applies.

If the predominant element strategy is chosen in formulating the system of inferential rules with three inputs, then for the conversion of the value x of the universe of the *input* linguistic variable having a positive or featureless influence on the output linguistic variable it applies that $u = 100 \cdot (x - x_{\min}) / (x_{\max} - x_{\min})$. In the case of a negative influence on the output linguistic variable, $u = 100 - (100 \cdot (x - x_{\min}) / (x_{\max} - x_{\min}))$ holds.

In both of the latter mentioned cases $x_{\max}$, or respectively, $x_{\min}$ is the highest, or respectively, the lowest given value x within the monitored period.

In our case, the output linguistic variable is the growth rate of the GDP in the year immediately following the monitored period. The percentage increase in investments (INV) increases the growth rate of GDP (a positive effect); high value of interest rates (LTI) tends to decelerate the GDP growth rate (a negative impact); unemployment (UNE) in connection with the real product at the level of its potential has a rather vague effect on the GDP growth rate.

2. Results of the Research

The course of the $\Delta\text{GDP}\%$ (see Table 1) during the period 2014 - 2017 shows a recession phase with a subsequent recovery in 2017 of the Greek economy. The economic growth is expected to continue in the coming years (see European Economic Forecast, 2018). The formulation of the **predictive fuzzy model for the year 2018** is based on the characteristics of this period.

A priori expected value of $\Delta\text{GDP}\%$ for the year 2018, according to the expert's opinion, is searched for within the limits of the given values $x_{\min} = 1$, $x_{\max} = 2.5$; e.g., the conversion of the $\Delta\text{GDP}\%$ value given in 2017 is $y_{17} \approx 27$ ($100 \cdot (1.4 - 1) / (2.5 - 1) = 26.66$). Analogously, for the converted values in 2017 of the given inputs the following applies:

- $u_{\text{LTI}} = 100 - (100 \cdot (6.1 - 6.1) / (9.7 - 6.1)) = 100$;
- $u_{\text{INV}} = 100 \cdot (3.3 + 4.7) / (3.3 + 4.7) = 100$;
- $u_{\text{UNE}} = 100 - (100 \cdot (21.5 - 21.5) / (26.5 - 21.5)) = 100$.

These outcomes result from the fact that all data uploaded in 2017 are the extreme values (maxima or minima) of the period under consideration. Generally, we can write:

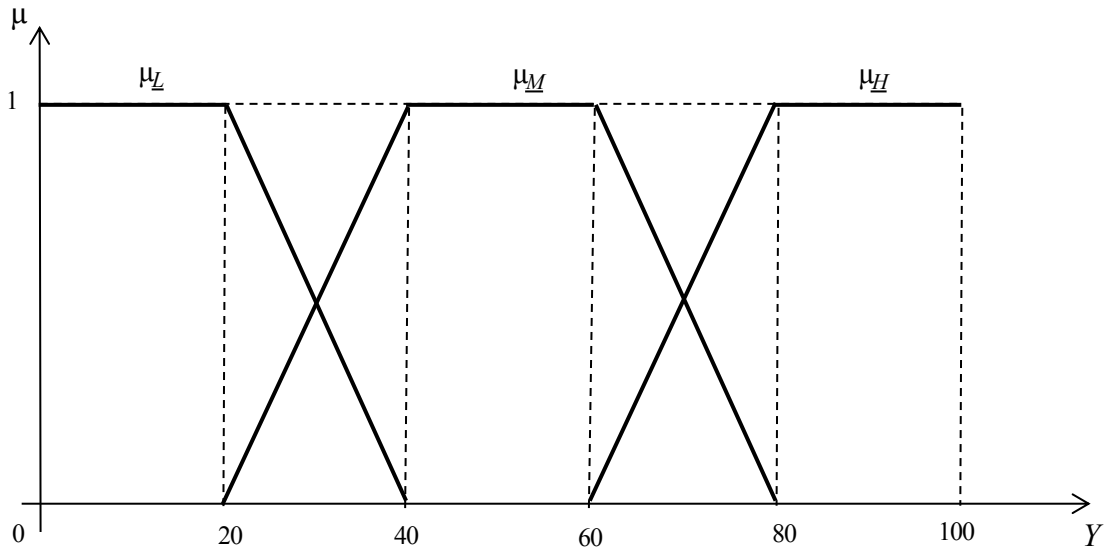
- $u_{\text{LTI}} = 100 - (100 \cdot (x_{\min} - x_{\min}) / (x_{\max} - x_{\min})) = 100$;
- $u_{\text{INV}} = 100 \cdot (x_{\max} - x_{\min}) / (x_{\max} - x_{\min}) = 100$;
- $u_{\text{UNE}} = 100 - (100 \cdot (x_{\min} - x_{\min}) / (x_{\max} - x_{\min})) = 100$.

Thus, the triple $(100, 100, 100) \in U = U_{\text{LTI}} \times U_{\text{INV}} \times U_{\text{UNE}} = \langle 0, 100 \rangle^3$ of internal (converted) input values has been created (see point 1 in section 1.1).

Because of the high *external* uncertainty (e.g., the uncertain impact on the Greek economy resulting from the approval of the reform package requested by creditors in the framework of the international rescue program – see Council of the European Union,

2018) and *internal* uncertainty of the model we choose the points a, b, c, d within the interval $\langle 0, 100 \rangle$ evenly distributed ($a = 20$, $b = 40$, $c = 60$, $d = 80$), (see formula (1) in Section 1.1). Therefore, the courses of the membership functions of the converted output and all the converted inputs are identical (Fig. 1, in which these courses are plotted above the domain of universe Y of converted values of the output linguistic variable):

Fig. 1: Courses of the membership functions with even distribution of the points a, b, c, d within the interval values $y \in Y = \langle 0, 100 \rangle$



Source: authors' own processing

The following *fuzzification table* valid for $i = \text{LTI, INV, UNE}$, whose elements are the values $\mu_{\underline{A}i}(u_i)$, where index $\underline{A} \in \{\underline{L}, \underline{M}, \underline{H}\}$, is derived from the above stated equations and inequalities:

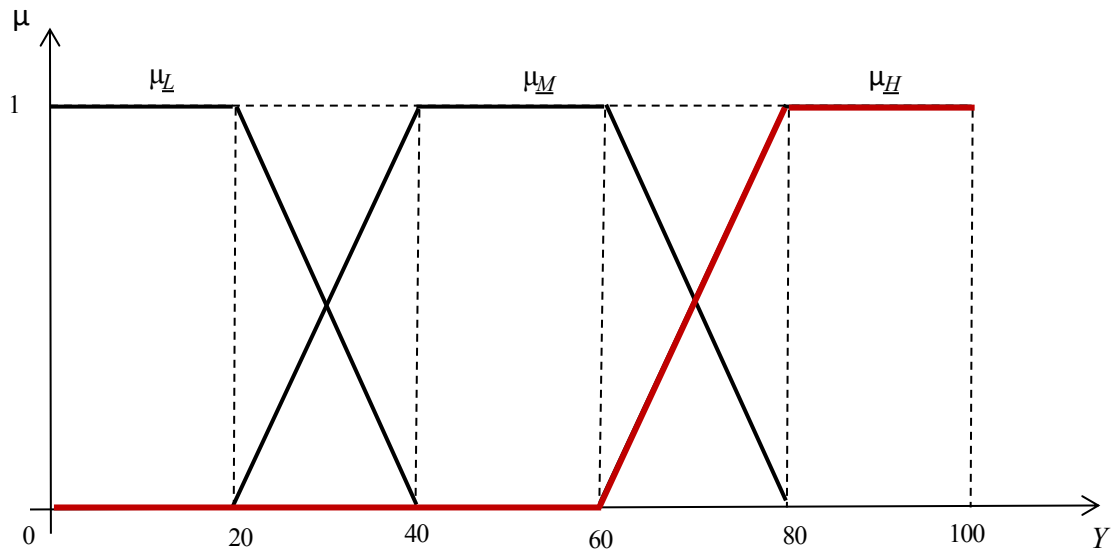
Tab. 2: Fuzzification table valid for $i = \text{LTI, INV, UNE}$

Interval	$u_i < 20$	$20 \leq u_i < 40$	$40 \leq u_i < 60$	$60 \leq u_i < 80$	$u_i \geq 80$
$\underline{L}_i$	1	$(40 - u_i) / 20$	0	0	0
$\underline{M}_i$	0	$(u_i - 20) / 20$	1	$(80 - u_i) / 20$	0
$\underline{H}_i$	0	0	0	$(u_i - 60) / 20$	1

Source: authors' own processing

In the *fuzzification table*, only non-zero elements are taken into account, with the help of which the input vector $(100, 100, 100) \in U$ generates the set $X = \{(\underline{H}_{\text{LTI}}, 1), (\underline{H}_{\text{INV}}, 1), (\underline{H}_{\text{UNE}}, 1)\}$. From its three elements only one element set $LF = \{(\underline{H}, \underline{H}, \underline{H})\}$ can be created. The triad $(\underline{H}, \underline{H}, \underline{H})$ of the input fuzzy sets of the projection F assigns the output fuzzy set $\underline{H}$ according to the already mentioned strategy of the predominant element. For $\mu_{\underline{AGG}}(y) = \max\{\min\{\min\{\mu_{\underline{A}1}(x_1), \dots, \mu_{\underline{A}n}(x_n)\}, \mu_{\underline{C}}(y)\} : \underline{C} = F(\underline{A}_1, \dots, \underline{A}_n), (\underline{A}_1, \dots, \underline{A}_n) \in LF\}$ it then applies $\mu_{\underline{AGG}}(y) = \max\{\min\{\min\{1, 1, 1\}, \mu_{\underline{H}}(y)\}\} = \max\{\min\{1, \mu_{\underline{H}}(y)\}\} = \mu_{\underline{H}}(y)$ (see the highlighted course of line in Fig. 2).

Fig. 2: The course of the membership function μ_{AGG}



Source: authors' own processing

For the certain integers values above the universe Y in the formula (2) it applies: $\int y \cdot \mu_{AGG}(y) dy = 2\,533$, $\int \mu_{AGG}(y) dy = 30$, therefore $y_0 = 2\,533 / 30 = 84.4$. After recalculation y_0 to $\Delta GDP\%$, we get the predicted value of $\Delta GDP\% = (84.4 \cdot 1.5 / 100) + 1 \approx 2.27$.

The **predictive fuzzy model for 2020** is based on the data of the 4-year period 2016 - 2019, with 2018 and 2019 (the highlighted columns) recording the econometric predictions of the respective values. For the conversion of the values of inputs given in 2019 in a general formula the same applies as we already encountered in 2017; again, we get the same vector $(100, 100, 100) \in U$ of recalculated inputs. All the operations with the fuzzy sets described above are repeated, μ_{AGG} coincides with μ_H (see Fig. 2), with the result $y_0 = 84.4$, from which we get $\Delta GDP\% = 2.27$.

3. Results Discussion

Both of the predictive tasks had a trivial solution from the fuzzy model point of view. This results from the fact that in the monitored period the values of the observed variables accelerating the GDP growth rate increased monotonically and the values of the observed variables slowing the growth rate of GDP declined monotonously.

Though, some differences can be identified in predictive fuzzy models for 2018 and 2020. The econometric forecast predicts a moderate deceleration in the GDP growth rate for 2019 compared to 2018. This deceleration is not signaled by the uploaded data and thus, they did not enter in the fuzzy model.

The interpretation of this situation is that the econometric model utilizes the information that the fuzzy model does not work with. Regardless of whether or not the expert who forms the fuzzy model has this information, he/she should respond to the predicted slowdown according to experience gained by changing the interval of a priori expected values of $\Delta\text{GDP}\%$. For example, by reducing $x_{\max}$ to 2.2 and increasing $x_{\min}$ to 1.1. Then, by the reverse conversion of y_0 to $\Delta\text{GDP}\%$ we obtain the predicted $\Delta\text{GDP}\% = (84.4 \cdot 1.1 / 100) + 1.1 \approx 2$ for the year 2020, i.e., at the level of the econometric forecast for 2019.

Conclusion

The aim of the paper was to present a general fuzzy system for solving managerial problems operating under conditions of internal uncertainty of the model of the solved task and formulated within the Zadeh's fuzzy approach, offering subjectively expected values as an alternative to statistically expected values. The fuzzy system works in conjunction with knowledgeable experts who, inter alia, based on experience gained, determine the limits of the interval in which the resulting value can be a priori expected; within these limits, the fuzzy algorithm then finds the "right" value.

The theoretical basis of the fuzzy algorithm leans on the transformation of one of the important concepts of fuzzy logic, the so-called extension principle, to the level of the linguistic variables and their terms in which the problem is solved. The fuzzy algorithm is applied in predicting the GDP growth rate of Greece in 2018 (compared to the reported econometric forecast) and 2020 (a new contribution to the paper). The forecast default data are the components of the previous four-year evolution of the three macroeconomic indicators (long-term interest rates, investments and unemployment). These are used in the fuzzy model formulation phase within which experts get the opportunity to take into account their knowledge and experience. The process of solving a task is purely mechanical independent of the human factor in which the data play the role of external inputs to the fuzzy algorithm.

Both of the predictive tasks had a trivial solution from the fuzzy model point of view that did not enable adequate demonstration of the technical complexity of the respective fuzzy operations. It resulted from the fact that in the monitored period the values of the observed variables accelerating the GDP growth rate increased monotonically and the values of the observed variables slowing the growth rate of GDP declined monotonously. Nevertheless, they allowed the demonstration of one of the ways through which the experts can correct the deficiencies of the fuzzy algorithm. The deficiency here was the missing information originating from the source which the fuzzy algorithm did not work with; the correction option was a change of interval limits of a priori expected result values.

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Analysis of Health Care Expenditures in the Czech Republic and European Union

Abstract

Health care expenditures account for a high share of government spending across EU countries and worldwide. There are many factors that influence them. The article is based on primary and secondary sources. Primary sources are based on the information gained from Czech statistical office, Ministry of Finance, OECD, Eurostat, European Commission, WHO etc. The aim of the article is to analyse health care expenditures in individual EU countries with a focus on predicting other health care expenditure in the Czech Republic. The prognosis of trend of healthcare expenditure and GDP, correlation analysis and Spearman coefficient will be used. Unlike the calculated prognosis according to European Commission statement there would be a slight decline in the economy and GDP expects a decline. The growth rate of the Czech economy this year will slow to 2.6 percent from last year's 2.9 percent. The European Commission predicted this in its spring economic outlook. Based on this analysis, dependency health expenditure of individual households and GDP in Czech Republic between 2010 and 2017 will be shown. Very interesting is also comparison results from the Czech Republic with another states in European Union. Similar trend as in Sweden, Great Britain, Croatia or Germany will be shown.

Key Words

health care, expenditures, correlation analysis, Spearman coefficient, GDP

JEL Classification: H51, I15, C38

Introduction

The provision of health care is becoming one of the largest sectors of the economy in developed countries. Increasing living standards, improving quality of life and, last but not least, extending the length and low birth rates that cause so-called aging populations raise concerns about the adequacy of resources, their uses, fairness, efficiency and health care efficiency. Rapid technological change, the high cost of innovative medical technologies, devices and, above all, medicinal products, growing patient expectations and aging population the need for not only higher health care spending, but also the inclusion of new resources in health financing. For this reason, the demand for financial

data for this area is increasing, as is their international comparison. To this end, a single statistical system "Health Accounts System" has been created, which is being gradually updated and implemented in all EU and OECD countries, thus providing a common framework for ensuring data comparability over time and across countries. Under Commission Regulation 2015/359, all EU countries are now required to submit health expenditure data according to the methodology set out in the Health Accounts System 2011 (SHA, 2011), (CZSO, 2019).

1. Methods of Research

The article is based on primary and secondary sources. Primary sources are based on the information gained from Czech statistical office, OECD, Eurostat, WHO etc. Secondary sources comprise information about expenditures on health care in the Czech Republic and abroad, professional literature, information collected from professional press, discussions or previous participations in professional seminars and conferences relating to the chosen subject. Then it was necessary to select, classify and update accessible relevant information from the numerous published materials that would provide the basic knowledge of the selected topic. (Hedvicakova, Pozdilkova, 2018), (Hedvicakova, 2018)

The aim of the analysis is to compare GDP growth and health expenditure, with the basic characteristic of the correlation analysis - Spearman coefficient. Its size will give us the result of whether these two curves are growing the same, or whether the growth of one is dependent on the growth of the other or vice versa.

Will the scientific question be confirmed or disproved: *Is health expenditure growth dependent on GDP growth?* The Spearman coefficient will be used to verify the scientific question. A Spearman correlation coefficient is an important characteristic in evaluating the validity of tests, because it determines how close together two related phenomena are captured. Thus, it allows quantitative determination of how far the two similar order are created. For the calculation, it is necessary to have a table in which you can specify individual correlated pairs, which are compared to the individual components of the correlation, overall index and the basic form of vector analysis. The result is a dimensionless number, which indicates the degree of correlation between individual freedom and the steam created for each pair of correlation. This method has also been used in other scientific articles. (Hedvicakova, Pozdilkova, 2018, 2018a)

2. Analysis of Household Expenditure on Health Care in the Czech Republic and in European Union

In 2017, total health care expenditures by households in the Czech Republic amounted to CZK 54,051 million, ie 14% of total health care expenditure. Since 2010, household spending on health care has increased by more than one quarter (27%), from CZK 42.7 billion in 2010 to CZK 54.1 billion in 2017. However, this increase was mainly due to in the last four years. Over the entire period under review, Czech households paid a total of

CZK 375.6 billion from their own funds for healthcare beyond the public health insurance system, with an average annual growth rate of 3.4% - out of which in the last three years they were from household pockets. CZK 155 billion. See Tab. 1 and Fig. 1. (CZSO, 2019).

Analysis is based on data from the Czech Statistical Office between 2010 and 2017. The health care expenditures in individual households are available for the years 2010-2017, so it was necessary to create a linear model based on a forecast for the years 2018 and 2019. (Hedvicakova, Pozdilkova, 2018)

Tab. 1: Direct expenditures of households on health care in the Czech Republic in billions of CZK

Year	Expenditures	Prognosis (Expenditures)
2010	42.7	
2011	44.0	
2012	44.2	
2013	43.5	
2014	46.5	
2015	49.4	
2016	51.2	
2017	54.1	
2018		55.6
2019		57.2

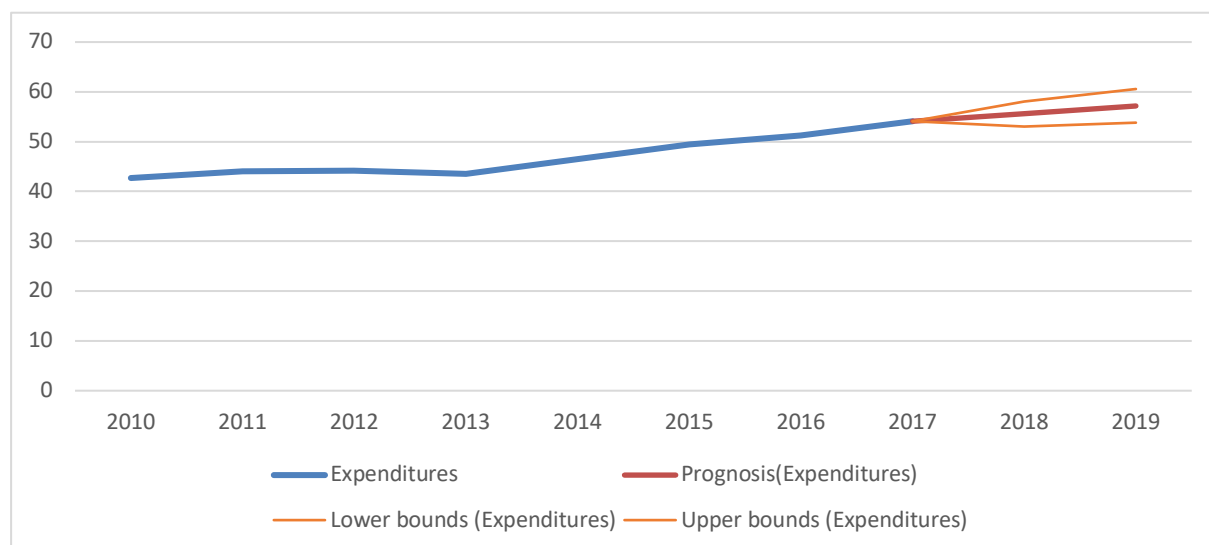
Source: authors' calculations in Excel, data from (CZSO, 2019, Braendle, Colombier, 2016)

Spearman coefficient between direct medical expenditures of individual households in the Czech Republic and GDP in years 2010-2017, came 0.7089, indicating a correlation between these two variables. By correlation analysis was verified dependency health expenditure of individual households and GDP in Czech Republic between 2010 and 2017. Table 2 and Figure 2 show GDP growth in the coming years. Although the prognosis of further growth of GDP and GDP per capita, currently already slowing down of further growth and to reduce forecasts. According to the Finance Minister of the Czech Republic (2019), the most important growth factor should be household consumption, which should reflect the still strong wage dynamics with extremely low unemployment rates and a sharp increase in old-age pensions. Positive, but to a lesser extent than in 2018, investment in fixed capital and general government consumption should contribute to growth, while the contribution of foreign trade should remain negative. The economic growth forecast of 2.4% is maintained for 2020.

Unlike the calculated prognosis according to European Commission statement there will be a slight decline in the economy and GDP expects a decline. The growth rate of the Czech economy this year will slow to 2.6 percent from last year's 2.9 percent. The European Commission (EC) predicted this in its spring economic outlook. In the February forecast, she still assumed that economic growth would remain at last year's pace. The Czech economy's estimate for next year's growth has fallen to 2.4 percent from a previously anticipated 2.7 percent. (European Commission, 2019)

According to forecasts, expenditures on health care should grow over the next two years (see to Tab. 1 and Fig. 1).

Fig. 1: Health Care Expenditures 2010-2017 and prognosis



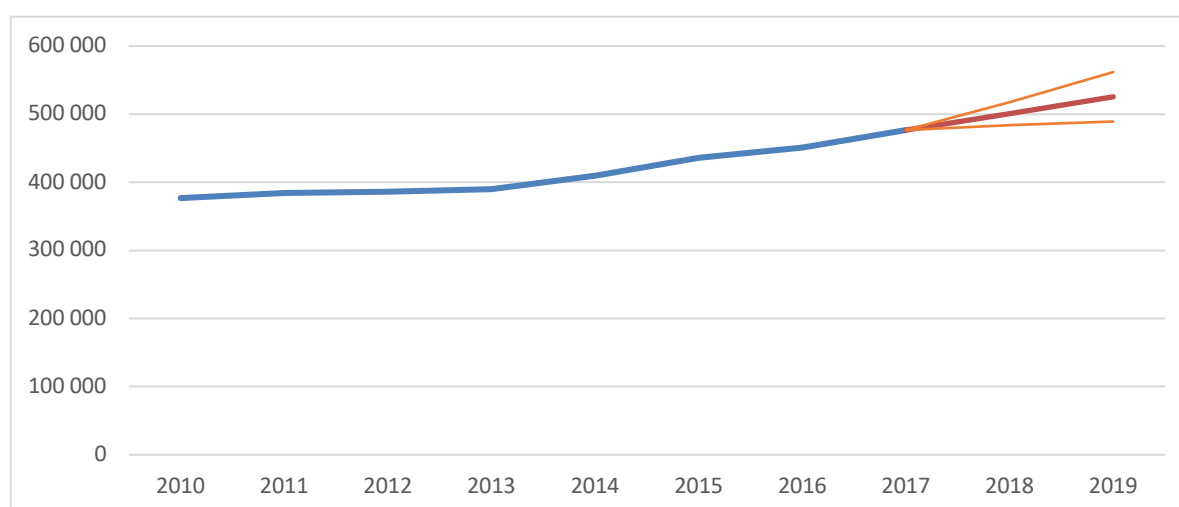
Source: authors' own calculations, data from (CZSO, 2019)

Tab. 2: GDP (total) in the Czech Republic in billions of CZK

Year	GDP	Prognosis (GDP)
2010	3 962 464	
2011	4 033 755	
2012	4 059 912	
2013	4 098 128	
2014	4 313 789	
2015	4 595 783	
2016	4 767 990	
2017	5 047 267	
2018	5 304 386	5 304 386
2019		5 562 936
2020		5 821 462
2021		6 079 988

Source: authors' own calculations, data from (CZSO, 2019a)

Fig. 2: GDP per capita in Czech Republic 2010-2017 and prognosis



Source: authors' own calculations, data from (CZSO, 2019a)

As GDP income grew, households' total healthcare expenditures increased proportionally, and the households' healthcare expenditure was reliant on GDP in Czech Republic. (Hedvicakova, Pozdilkova, 2018)

Since 2013, the percentage of current health care spending started to grow until 2016, when it peaked at 14.2%. The percentage of current expenditure on household healthcare fell to 14% in 2017. According to the forecast, percentage of current health care expenditure should grow to 14.4% and 1,6% in the next two years. See Tab. 3.

Very interesting is comparison results from Czech Republic with another states in European Union. The strongest representation of households in health care funding in 2016 was in Bulgaria (48%), Latvia and Cyprus (both 45%) and the lowest in France (10%). The EU average was 16%. Direct household payments in the Czech Republic accounted for 15% of health care funding in the same year, similarly as in Sweden, Great Britain, Croatia or our neighbor in Germany (12%). In Austria and Slovakia, this share corresponds to about 18% and in Poland, health funding through direct patient expenditure has reached 23%. (CZSO, 2019).

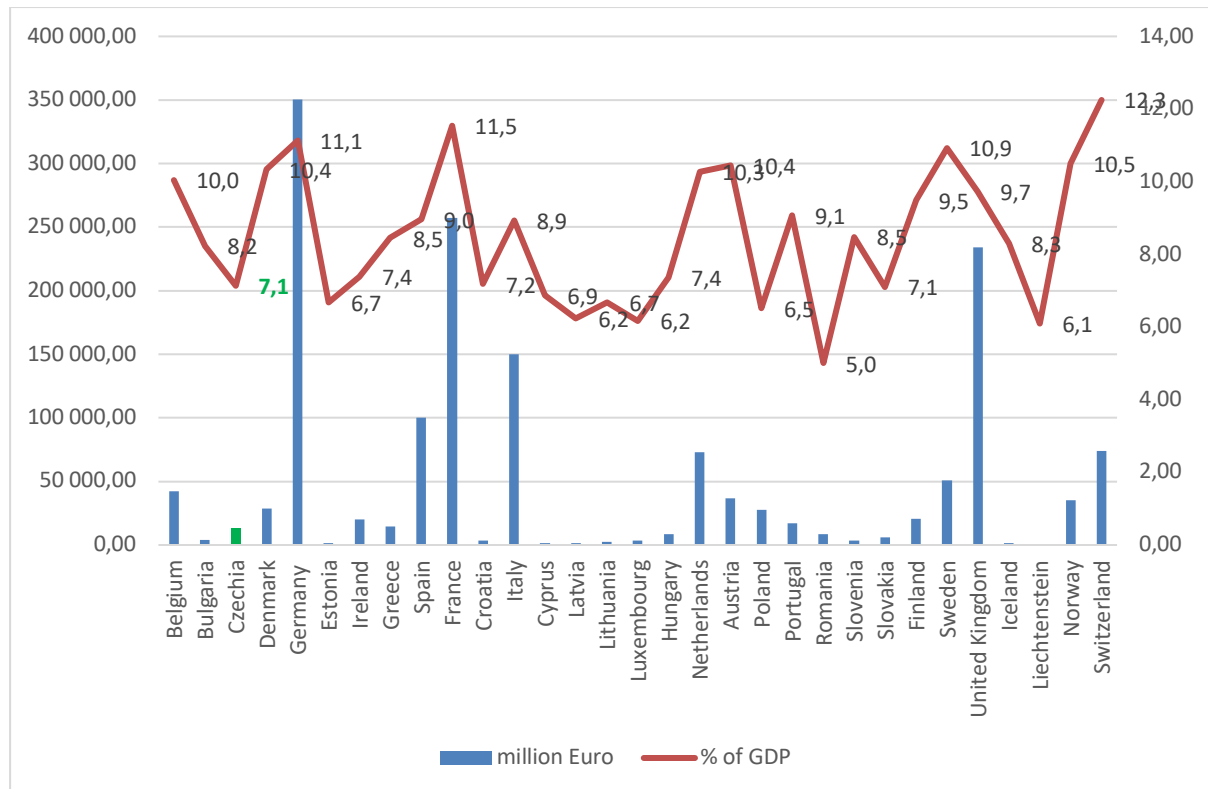
In absolute terms, a total of € 1.5 trillion was spent on health care in the European Union in 2016, of which about one quarter (EUR 350 billion) was for Germany, less than one fifth (EUR 257 billion) for France, 16% (EUR 234 billion) for Great Britain and one tenth (EUR 150 billion) for Italy. These four countries accounted for two-thirds of total EU health spending. For comparison in the Czech Republic, it was EUR 12.6 billion, which accounted for 0.85% of total EU-28 expenditure. It was 16 highest value. For comparison the United States spends almost twice as much on health care as the entire EU. (CZSO, 2019, Eurostat, 2019). See Fig. 3.

Tab. 3: Percentage of current health care expenditure in the Czech Republic

Year	% of current health care expenditure	Prognosis (Expenditures)
2010	12.8	
2011	13.0	
2012	12.9	
2013	12.6	
2014	13.3	
2015	14.0	
2016	14.2	
2017	14.0	
2018		14.4
2019		14.6

Source: authors' calculations in Excel, data from (CZSO, 2019)

Fig. 3: Expenditures on Health Care in EU in 2016



Source: authors' own calculations, data from (Eurostat, 2019)

In terms of health care expenditure as a percentage of GDP, the highest figure recorded in 2016 was in France (11.5 %), followed by Germany (11.1 %) and Sweden (10.9 %). The three EU countries with the lowest shares of GDP were Romania (5.0 %), Luxembourg and Latvia (both 6.2 %). See Fig. 2 (Eurostat, 2019). The healthcare expenditure in the Czech Republic was equivalent to 7.1 % of GDP.

3. Discussion

Marešová, Mohelská and Kuča (2015) identify the main factors that affect future trends in healthcare expenditures from the perspective of the anticipated age of the population. It follows from the analysis that the basic determinants of public healthcare expenditure are the demographic structure, income, the legislative conditions and productivity. The aim of effective public health care spending should not only be achieved by a higher age, but also by enabling the prolonged period of their work productivity and self-sufficiency. It is also necessary to explore the estimating the impacts of economic growth and environmental quality on health expenditure (Yazdi, Khanalizadeh, 2017). There are a number of major studies which have demonstrated a clear link between socio-economic background (such as income or occupation) and health too (Pacáková, Kopecká, 2018). With the development of the fourth industrial revolution called Industry 4.0, there is a massive introduction of modern technology, innovation and ICT, which are gaining ground in health care. The high cost of innovative medical technologies and devices raises the increased need not only for higher health care spending, but also for the inclusion of new resources in health financing. Factors affecting the level of spending on health care is of course more. Other factors include the basic macroeconomic indicators such as inflation, unemployment, etc. Economic situation, economic condition and company structure in the country, in state ownership or family business (Antlová, Rydvalová, Popelínský, 2017) affect the income and expenditure on health care. Finally, on health care spending reflected the current wave of migration. It is necessary to define key factors influencing health care expenditures and predict their further development.

As mentioned above, the biggest problem is the growing number of old people. The question in the discussion is how to effectively address this problem. One way is to increase spending on disease prevention or to increase health spending on GDP. Also, should raise awareness among patients about disease prevention and healthy lifestyle. Another issue to discussion is why health care expenditures are in individual EU countries so different and what causes the high cost of health care, particularly in countries with the highest health care expenditures per inhabitant such as. It is also necessary to examine the differences between the percentage of gross domestic product in health care expenditure.

Conclusion

Health care expenditures account for a high share of government spending across EU countries and worldwide. There are many factors that influence them. The aim of the article was to analyze health care expenditures in individual EU countries with a focus on predicting other health care expenditure in the Czech Republic. The correlation analysis and Spearman coefficient were used. Based on this analysis, dependency health expenditure of individual households and GDP in Czech Republic between 2010 and 2017 was shown. The scientific question has been confirmed. Given the proven dependence of health expenditure on GDP, it will depend on further developments in GDP and the economic cycle. According to the European Commission outlook, GDP growth should slow down.

Health care expenditure per inhabitant was €5,000 or higher in three EU Member States in 2016: Luxembourg (€5,600), Sweden (€5,100) and Denmark (€5,000). The three countries with the lowest health care expenditure per head in 2016 were Romania (€400), Bulgaria (€600) and Poland (€700). In contrast, Luxembourg and Latvia (both 6.2 %) and Romania (5,0%) were EU countries with the lowest shares of GDP (Eurostat, 2019). For this reason, it is necessary to look at the issue of health care expenditure in a comprehensive way, taking into account macroeconomic indicators.

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Quality of Government, stocks of innovation skills and level of economic activity in European regions

Abstract

This paper investigates the relationship between quality of government, R&D and innovation capacity and economic activity in European regions. We employ regional data (NUTS 1 and NUTS2) describing quality of government by European Quality Government Index (EQI) and regional human resources in science and technology (HRST) data as a proxy for stock of innovation skills in the economy. We find an overall linear positive and significant relation between levels of GDP per capita on the one hand, and HRST and quality of governance (EQI) on the other. We also identified three groups of European regions. There is no difference in GDP levels between the group of Northern European regions and the group of the Southern European regions given the levels of EQI and HRST. Conversely, the group of regions in new member states (NMS) is an important explanatory variable of GDP per capita in European regions, with significantly lower levels of GDP p.c. than the other two regions. We interpret these results by drawing from seminal contributions in the literature of economic growth. We particularly reflect upon how differently the relationship between democratic institutions, trust and corruption (Rothstein, 2011, Mauro, 2004, Acemoglu et al., 2001 and Acemoglu et al., 2002) on the one hand, and the role of stocks of skills for innovation and research on the other, may play out in these three regional clusters.

Key Words

European Quality Government Index, HRST, European regions, economic performance

JEL Classification: R10, R11

Introduction

The quality of government and adequate high-skilled competences and human resources in science and technology (HRST) has been claimed to be drivers of economic activity at a national level. This paper provides evidence that this claim is also true at the regional level. The vast majority of studies analysing these relationships did that on the basis of country-level data. In this paper we employ data from the European Quality Government Index (EQI) at the regional level as well as EUROSTAT data for economic activity and science and technology (NUTS 1 and NUTS2). The advantage of EQI-database is, among other benefits, that it enables analysis separating between metropolitan areas and the rest of regions of the country, a dimension we find highly significant in our study. Low quality of governance is associated with high corruption, high inequality and low level of trust in

a society. Rothstein (2001) demonstrates how low corruption, low inequality and high trust stimulate in various ways economic activity. Conversely, various aspects of low quality of governance result to vicious cycles of social behaviour with negative effects for economic activity and growth.

Aghion and Howitt (2008) is a standard reference of models of endogenous growth with institutions, innovation and education as important determinants to economic growth. Murvey, Schleiffer and Vishny (1993) argue for the existence of multiple equilibria and low growth traps due to excessive rent-seeking, in particular public rent seeking by government officials, and the existence of critical values (thresholds) tilting the system from a high-growth to a low-growth equilibrium scenarios. These studies show why it is appropriate to address the issue of governance in the context of economic activity, also at the regional level.

The European Quality Government (EQG) Index focusses on both perception of government quality and experiences with public sector corruption, along with the extent to which citizens believe various public sector services are impartially allocated and of good quality. The survey, conducted by The Quality of Government Institute (2019), includes 16 questions. The core of them focusses on “quality of public education, public health, law enforcement in respondent's area”, “perceived fairness and ability to report political corruption of media”, “perceived corruption of media”, “perceived corruption of the public health, education, and law enforcement system” and “respondents own experience with bribery in the public sector”.

On this basis of evidence, we believe that a more careful investigation of the relation between on the one hand democratic institutions, cultural heritage, corruption (Mauro, 2004, Acemoglu et al. 2001 and Acemoglu et al. 2002) and on the other stocks of skills for innovation and research activities in modern knowledge regional economies as determinants of economic activity is justified from a theoretical point of view.

1. Methods of Research

The European Quality Government index is measured by 16 sub-indexes. Similar index is measured by e.g. World Bank – Worldwide Governance Indicators description (WGI) (World Bank, 2015) and also exists many other similar indexes with linkages to quality of government: International Country Risk Guide (ICRG) (International Country Risk Guide, 2015), Corruption Perception Index (CPI) (Transparency International, 2015). All mentioned indexes (or groups of indexes) are constructed based on country level. For purposes of subnational (regional) analysis is available only The European Quality of Government Index (EQI) (Charron, Dijkstra, Lapuente, 2014, Charron, 2013 and Charron 2014).

The uniqueness of an approach based on regional allows sensitively capture the diverse cultural backgrounds in the same country (as is the case in Italy) and also cultural differences among countries. For this reason, we employed data from two regionally-focused surveys which was carried out under the projects of The Quality of Government Institute (2015) funded by the EU Commission in 2010, 2013 and 2017.

The survey from 2010 consists of QoG and demographic-based 34 questions. The total number of respondents was 33540. The survey from 2013 consists of 32 questions and the total number of respondents was 85248. And lastly, the survey from 2017 consist of 18 questions and the total number of respondents was 78000. All three surveys are based on the European Union's NUTS statistical regional level (in most cases on NUTS 2 and in particular cases based on NUTS 1). Survey 2010 covers 18 countries resp. 24 countries in 2013 resp. 21 countries in 2017.

Sample size per country will vary depending on the number of regions. The survey from 2013 resp. 2010 selectively sampled more than 400 (resp. more than 200) citizens per region (thus e.g. Belgium was in the survey from 2013 represented by 3 regions at NUTS 1 level and total number of respondents was 1208).

To get more robust results we used arithmetic average of indexes from three surveys (from 2010, 2013 and 2017) we employ regional composite indicator of quality of government. Because of focus on quality of government, HRST and regional product we removed regions with missing values in connections with mentioned indexes. Therefore, our sample consists only of the following 186 regions of 21 states: Austria (9 reg. NUTS 2), Belgium (3 reg. NUTS 1), Bulgaria (6 reg. NUTS 2), Croatia (2 reg. NUTS 2), Czech Republic (8 reg. NUTS 2), Denmark (5 reg. NUTS 2), Finland (2 reg. NUTS 2), France (22 reg. NUTS 2), Germany (16 reg. NUTS 1), Greece (4 reg. NUTS 1), Hungary (3 reg. NUTS 1), Italy (21 reg. NUTS 2), Ireland (2 reg. NUTS 2), Netherlands (12 reg. NUTS 2), Poland (16 reg. NUTS 2), Portugal (7 reg. NUTS 2), Romania (8 reg. NUTS 2), Spain (17 reg. NUTS 2), Slovakia (4 reg. NUTS 2), Sweden (3 reg. NUTS 1), United Kingdom (12 reg. NUTS 1). In the case of Finland, Ireland, Netherlands and Croatia are available data only from survey 2013.

We removed one region countries such as Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta, Slovenia, as well as Ukraine and two regions in Spain, the Ciudad Autónoma de Ceuta and Ciudad Autónoma de Melilla and finally one French region: Mayotte. Due to missing values of regional output we removed regions of Serbia and Turkey and due to missing HRST values we removed 4 French islands (Guadeloupe, Martinique, Guyane and Reunion) and 3 regions in Finland (Itä-Suomi, Etelä-Suomi, Pohjois-Suomi).

For capturing socio-political and, perhaps, cultural diversities we defined three distinct regional geographic groups¹ – South, North and New Member States. The group named “South” consists of regions of Greece, Spain, Portugal and 8 regions of southern Italy (Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia and Sardegna). The group named “North” consists of regions of Austria, Belgium, Denmark, Germany, Finland, French, Ireland, Italy (only 13 northern regions: Piemonte, Valle d'Aosta, Liguria, Lombardia, Bolzano, Trento, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Toscana, Umbria, Marche, Lazio), Netherlands, Sweden, United Kingdom. The group named the “New Member States” consists of regions of these countries: Bulgaria, Czech Republic, Croatia, Hungary, Poland, Romania and Slovakia.

¹ Similar geographic groups, but on the state level, was used for example in Melecky (2013).

The dependent variable is GDP per capita in Purchasing Power Standard (PPS) and main indicator capturing quality of governance is the European QoG Index (EQI).

HRST is defined as (Eurostat – HRST, 2015) human resources in science and technology by occupation. The unit of this variable was the number of people employed in ISCO 08 major groups 2 and 3 as percent of economic active population.

In addition we employ five dummy variables: Region with Capital City (1 = region with capital city), South (1 = region from the South group), North (1 = region from the North group) and dummy variables for the records from the year 2013 (D_2013) and 2017 (D_2017).

The hypotheses to test are:

H1: High quality of government has positive impact on regional economic performance measured by GDP p.c.

H2: HRST has positive impact on regional economic performance measured by GDP p.c.

2. Results of the Research

Tables 1 and 2 present descriptive statistics of the key variables in total and by the three regional groups as well as for the regions that include a capital city.

Table 1: Descriptive Statistics – part 1 (year 2017)

Group	North			South			NMS			Total		
Variable	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N
GDP	32204.0	8648.2	99	23144.4	5394.3	36	19064.7	9056.0	51	26847.8	10100.0	186
EQI	63.8	15.8	99	36.8	17.4	36	29.9	12.7	51	49.3	21.9	186
HRST	34.3	4.8	99	22.9	4.7	36	26.1	6.5	51	29.9	7.2	186

Source: authors' own calculations, data from (Eurostat, 2019) and (QoG, 2019)

From the result table above (see Tab. 1), the descriptive statistics indicates that all the variables, GDP, EQI and HRST show the expected differences of mean values among the examined regional groups. The highest standard deviation of GDP (14530.4) is recorded in the New Member States group, while the lowest standard deviation (4432.1) is recorded in the South group. The highest average of EQI is recorded in the North group (63.8). On the other hand, the lowest average value (29.9) - as well as its standard deviation (12.7) - is recorded in the NMS group. The lowest HRST average value (22.9) is recorded in the South group - the lowest standard deviation (4.7) as well. Conversely, the highest average HRST is recorded in the North group.

Table 2: Descriptive Statistics – part 2 (year 2017)

Group	Reg. with capital city			Reg. without capital city			Total		
Variable	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N
GDP	40911.1	10859.7	18	25341.1	8797.7	168	26847.8	10100.0	186
EQI	46.1	23.8	18	49.6	21.7	168	49.3	21.9	186
HRST	39.3	6.0	18	28.8	6.6	168	29.9	7.2	186

Source: authors' own calculations, data from (Eurostat, 2019) and (QoG, 2019)

The table above (see Tab. 2) presents descriptive statistics for regions with and without capital city. The average GDP for regions with a capital city is by 61% higher than that of „non-capital regions“. It is worth noting that HRST is fairly higher in major regions. Although these regions also have a slightly lower average quality of administration than regions without capital.

Table 3: Estimates of Beta coefficients (dependent variable: regional GDP)

Independent variables	Regression model	VIF
Constant	-2254.7 (1248.5)	
EQI	33.56* (17.03)	2.751
HRST	640.3** (53.6)	3.075
Region with Capital City	8534.8** (951.3)	1.624
South	7227.1** (711.4)	1.622
North	7249.9** (780.4)	3.112
D_2013	1072.6 (582.3)	1.547
D_2017	2248.7** (625.1)	1.783
Adj. R sq.	0.703	
N	558	

Note 1: ** Significant at 99 per cent; * significant at 95 percent.

Source: authors' own calculations, data from (Eurostat, 2019) and (QoG, 2019)

The regression results (see in Table 3) indicates that the specified model has a fairly high coefficient of determination (adjusted R-square 0.71). The estimated coefficient of the independent variable EQI is statistically significant (p-value 0.05). For every additional point of European Quality Index, the regions increase its economic performance measured by GDP to the level of 33 Euro per capita in PPS (regardless of geographic areas of regions). The coefficient of the variable HRST exhibits the expected positive sign and it is highly significant. It thus indicates that for every additional percentage of HRST, the regional GDP increases by the level of 640 Euro per capita in PPS. Both hypotheses were not rejected. The regression result equally indicates that the coefficients of the dummy

variables South, North and D_2017 are positive and statistically significant (only D_2013 variable is not significant).

That the dummy variables North, South and D2017 are highly significant is an indication that unobserved but stable variables are accounted for in the present regression model.

A possible critique against the simple, but apparently parsimonious and robust, OLS-regression model we employ here, may be that of endogeneity problem. It is not difficult to imagine that HRST may be dynamically linked to GDP, i.e. the higher the GDP we expect to find higher shares of HRST personell in the active population. We know from a number of studies that total national R&D funding (GERD) is positively correlated with GDP per capita. The Pearson correlation coefficient between HRST and GDP variables is $r = 0.752$ and highly significant. To overcome the endogeneity problem would imply to solve a more complicated system of structural equations or the use of instrumental variables or both. Correlations between standardised and unstandardised predicted values and standardised and unstandardised residuals reveal a weak but significant negative Pearson coefficient ($r = -0.120$), a fact that in deed might be interpreted as an indication of endogeneity problem. In future research, we shall explore the same research questions with the help of more advanced statistical methods, in particular, various structural equation model (SEM) schemes.

3. Discussion

Endogenous growth economic theories suggest that both innovation capacities and institutions matter in various ways (Aghion and Howitt, 2008). North (1991) defines institutions as *the rules or constraints on individual behaviour*. Institutions and related policies such as education, health services, protection of civil and property rights are common goods of fundamental importance for the functioning of modern economies and societies, and hence regions. It is an issue to debate whether basic institutional arrangements are to be considered as more or less comparable across the EU or not. On the other hand, there is no doubt that there are variations in effectiveness and efficiency of governance. Rothstein (2011) argues that social capital, defined as access to beneficial social networks, and generalised trust in other people, tend to be determined by the QoG and not the other way around. Thus, it is reasonable to assume that QoG is a causing factor of high economic performance.

The long-term research conducted at the Quality of Governance Institute equipped us with solid indicators and data on QoG. These data demonstrate clearly that there are not only differences in quality of governance between European countries, but also within the same countries and between regions. Table 1 depicts the considerable differences between regions in the North countries compared with the regions in the South and the new member states. And these differences correlate with differences in regional GDP.

The question we set out to investigate in this paper is, however, how strong factor is the QoG in explaining differences in regional GDPs compared to another major drive of economic growth, that is R&D and innovation capacities, proxied as the share of human resources for science and technology (HRST) of the economic active population. Into a certain extent one could argue that this variable is a proxy for the share of knowledge economy activities within a region.

We experimented with many different regression models, including hierarchical regression models (Kaloudis and Svoboda, 2016). We concluded that the regression analysis presented above is the most simple and robust of all models employed. Table 3 above suggests that the share of HRST is a far more important explanatory factor of regional economic performance than QoG-index. Although the complexity of this issue is large and the model we employ is relatively simple, we believe that there are important regional, national and European implications to draw from this exercise. There is no doubt that we should intensify the struggle to improve the QoG and to reduce corruption within the entire EU. However, it is even more important to expand and develop the regional capacities to develop new knowledge and to innovate. That has been, especially the last decade, a key policy priority of the EU-policies as indicated in the spending for Structural Funds, Horizon 2020 and a number of other European programmes.

Furthermore, our results suggest that QoG and R&D capacities are to a certain extent distinct economic impact factors, that is, whatever the level of QoG, investing in knowledge infrastructures seem always to be beneficial. QoG patterns change slowly and are entrenched in a different social and cultural web of practice. It is quicker and easier to work through the channel of strengthening the performance of knowledge economies, if the goal is to achieve a rapid increase of regional GDP. Perhaps, few examples in Europe demonstrate this fact better than Estonia.

Conclusion

Our results show that quality of government and the share of high skilled human capital (HRST) has significant and positive effect on GDP per capita (especially in the case of regions of North and NMS groups). There is no difference in GDP levels between the group of Northern European regions and the group of the Southern European regions given the levels of EQI and HRST. Our study confirmed the importance of skilled human capital and also Rothstein's conclusions, which emphasize that low corruption, low inequality stimulate economic activity in various ways. The limitations of the present research are many. Future research would develop more sophisticated estimation models in order to explore better causal relations and to check for possible endogeneity issues pertinent in this analytical approach.

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Relationship of Fair Value Estimated by Analysts and Price Movement in Case of ČEZ, a.s. stock

Abstract

According to the semi-strong form of efficient market hypothesis all the publicly known information are reflected in the price. On the other hand, there are many analysts, usually brokerage firms or banks, who provide the so-called recommendations for stocks. These recommendations consist of the estimated fair value of the stock and the suggested action for investors. In the paper, we focus on the examination of analysts' recommendations in case of publicly traded stock ČEZ, a.s., concretely, we study the relationship between the potential future return as predicted by analysts and truly observed future return, both calculated in one-year period starting the day of recommendation issuance. We find out that there is no relationship between these two returns, which means that the analysts cannot predict the fair value in case of ČEZ, a.s. and therefore their recommendations are useless to the investors. Moreover, we examine the relationship between the percentage change of fair value in two successive recommendations and percentage price change in the same period. From our analysis, we can conclude that the change of fair value is affected by the price change in the same period. These findings are in line with semi-strong market efficiency hypothesis and support this hypothesis.

Key Words

analyst's recommendations, fundamental analysis, empirical finance

JEL Classification: G12, G14

Introduction

According to the semi-strong form of efficient market hypothesis (see Fama, 1970) all the publicly known information are reflected in the price. This means that by applying technical and fundamental analysis we are not able to identify the undervalued and overvalued stocks. On the other hand, there are many analysts, usually brokerage firms or banks, who provide the so-called recommendations for stocks. These recommendations consist of estimated fair value of the stock and suggested action for investors. The suggested action is usually of buy, sell or do nothing type and it is based on the difference between the estimated fair value and the actual market price. Exact types of the suggested actions differ for different analysts. The common information in the recommendations is the presence of fair value estimated by analyst, which is usually obtained by means of fundamental analysis and represents the analyst's opinion on the price of the stock in one year from the issuance of the recommendation.

There is obvious contradiction. If the market is efficient, the analysts cannot forecast price movement in one-year period. There exist some studies focused on the analysts'

recommendations in the literature. These studies are dedicated mostly to the price movements after the upgrade or downgrade of the recommendation (the change in suggested action). For instance, Womack (1996) studies the price drift after the issuance of recommendation and finds that analysts appear to have market timing and stock picking abilities. Kudryavtsev (2018) extends the analysis and explores stock price dynamic after analysts' recommendation revisions in the dependence on the abnormal return in the day of recommendation issuance. Most of the empirical studies are, however, focused on US stock market. We are not aware of any similar study considering Czech stock market; however, we can mention some researches of efficient market hypothesis considering Czech stock market. These studies mostly reject the weak-form efficient market hypothesis (see e.g. Filáček et al., 1998, Vošvrda and Žikeš, 2004).

In the paper, we analyze the relationship between the analysts' recommendations and the price drifts in the following period. To be more specific, we focus on the predictive ability of the analysts' fair values, i.e. whether the analysts can on average predict the price in one year period. The paper is structured as follows. In the next section, we briefly describe the dataset and methodology, which we apply in the paper. In the second section, we present the obtained results, which are discussed. In the conclusion section, we briefly summarize the findings.

1. Dataset and the Methodology

For our analyses we created the dataset of analysts' recommendations, the dataset of market prices and the dataset of paid dividends in the period 2006-2018. The dataset of analysts' recommendations was obtained from Patria (2018). The original dataset was modified in the following ways: i) we merged the names of recommending institutions (i.e. analysts), which changed during the analyzed period and two or more different names corresponds to the same institution; ii) we deleted all recommendations from the institutions which issued less than four recommendations; iii) all fair values in recommendations were converted to CZK. After these modifications, the dataset consists of 455 recommendations from 33 different analysts; see the summary in Fig. 1.

The second dataset, which we utilize in our analyses, is the dataset of market prices and dividends. Source of both is Kurzy.cz (2018a, 2018b). From this source we obtained the closing prices and dividends with their ex-dividend dates. Both time series were merged together such that the dividends are recorded at ex-dividend date. Although the payment date follows several months (1-2) after the ex-dividend date, we have not discounted the dividends as there would not be a significant change in the values. At the same time, we have not assumed the tax imposed on dividends (15%). The evolution of market price and paid dividends is depicted in Fig. 2.

Further in the paper, we assume that the total return r can be calculated as capital return r_c plus gain from dividends r_d ,

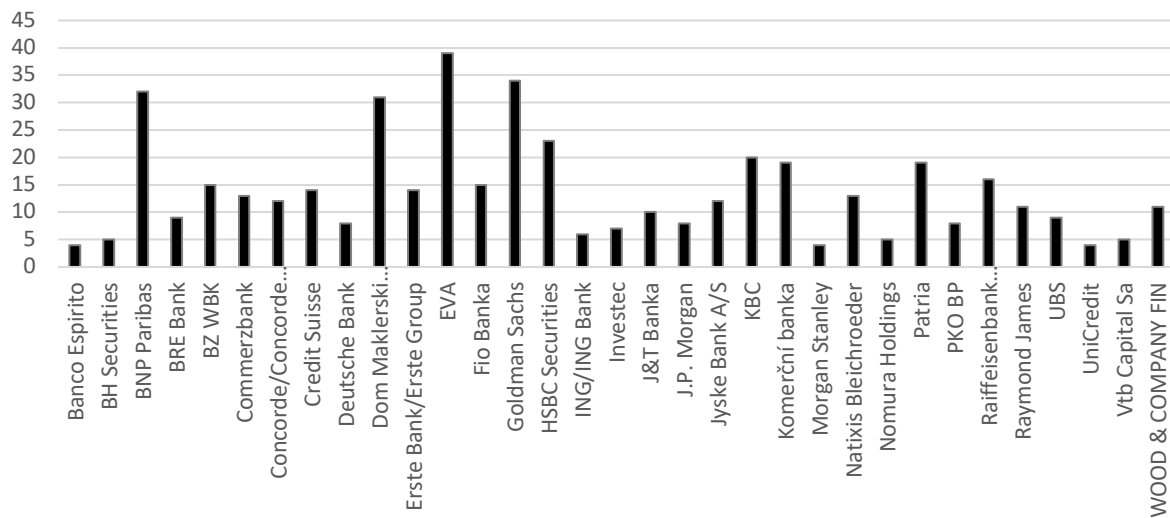
$$r = r_c + r_d. \quad (1)$$

Capital return can be calculated as a percentage change of the price p over the period, i.e.

$r_c = \frac{p_{end}}{p_{beginning}} - 1$. Dividend gains are calculated as dividends d paid in the period

divided by the price at the beginning of the period $r_d = \frac{d}{p_{beginning}}$.

Fig. 1: Quantity of recommendations from particular analysts



Source: authors' own calculations, data from (Patria, 2018)

Fig. 2: Evolution of market price and dividends paid in the analyzed period (values in CZK)



Source: authors' own calculations, data from Kurzy.cz (2018a, 2018b)

In our study, we examine whether there is any predictive edge in the analysts' recommendations. We specifically focus on the estimated fair value. Let us assume the following dependence: the future return from the stock ČEZ, a.s. depends on relative difference between the market price at the day of recommendation issuance and fair value estimated by analyst. We can test this dependence by regression analysis:

$$r_{365} = \alpha + \beta \cdot \left(\frac{fv - p_0}{p_0} \right) + \varepsilon, \quad (2)$$

where α, β are estimated coefficients (the intercept and the slope), fv is the fair value estimated by analyst, p_0 is the price at the day of recommendation issuance, r_{365} is the observed return in one-year period (i.e. in 365 calendar days from the publication of recommendation) and ε represents the error term. Moreover, we assume two cases of the regression equation: i) the dependent variable is the capital return, i.e. $r_{365}=r_c$ and ii) the dependent variable is total return, i.e. $r_{365}=r$. The reason we assume both versions is that we can dispute whether dividends can be estimated by analysts and whether we should look at the relationship (2) from the point of view of analyst accuracy verification (i.e. we are interested in the capital return only) or from the investor's point of view (i.e. we are interested in the total return). We further call the part $\frac{fv - p_0}{p_0}$ as potential return, because it in fact represents the potential profit estimated by the analysts (i.e. how much the stock is undervalued).

When we estimate the regression equation (2) we are interested in the parameter β . The ideal situation is if $\beta = 1$, which means that the analysts can perfectly predict the future price evolution (i.e. they are able to identify the undervalued and overvalued stocks) or that the market perfectly follows their recommendations. However, we do not expect this situation to be found. The more probable situation is that $0 < \beta < 1$. In this situation, we can conclude that the analysts have some predictive power, i.e. the estimated fair value provides some useful information to the investors. However, there can be also the case in which $\beta < 0$. According to this result, we can conclude that the analyst are usually wrong about the future price (i.e. fair value) or that the price does not approach their fair value in one-year period. However, surprisingly, even in this situation the analysts provide some useful information to the investors. They just must do the opposite action than suggested by analysts. Finally, $\beta = 0$ means that there is no predictive power, i.e. the analysts' recommendations are useless to the investors. To test this, we can formulate the following null hypothesis:

$$H_0 : \beta = 0, \quad (3)$$

with alternative hypothesis,

$$H_A : \beta \neq 0. \quad (4)$$

In order to decide whether we can reject the null hypothesis, we can apply the so-called t-test, i.e. we compare the calculated t-statistics,

$$t_{df} = \frac{\beta}{\sigma_\beta}, \quad (5)$$

where σ_β is standard deviation of β and df are degrees of freedom, with the calculated critical values based on chosen significance level. Due to the specification of H_A we apply two-side test.

Alternatively, we can use the p-value approach, i.e. we determine the p-value from the calculated statistics such that it is the lowest significance level for which we can reject the null hypothesis. Note that the p-value equals to the so-called type I error – the probability of H_0 being correct in the case of its rejection. The p-value is then compared to chosen significance level. If p-value is lower than significance level, we reject H_0 and accept H_A . If p-value is higher than significance level, we accept H_0 and reject H_A . In our paper, we set the value of significance level to 15% in order to minimize the type II error (i.e. the probability of H_0 being incorrect in the case of its acceptance), which we consider costlier than type I error. We are aware of the problem with choosing the optimal significance level, see e.g. Kim and Ji (2015), but due to the restricted length of the paper we do this simplification. Simply speaking, the higher the p-value, the more confident we are in accepting the null hypothesis, because the lower the type II error, which is in the reverse relationship to the p-value.

Moreover, we also study what influences the analysts' recommended fair value. In our paper, we assume that the updated fair value depends on the price change in the period between previous and updated recommendation. Let us assume the following regression:

$$\Delta fv = \alpha + \beta \cdot \Delta p + \varepsilon, \quad (6)$$

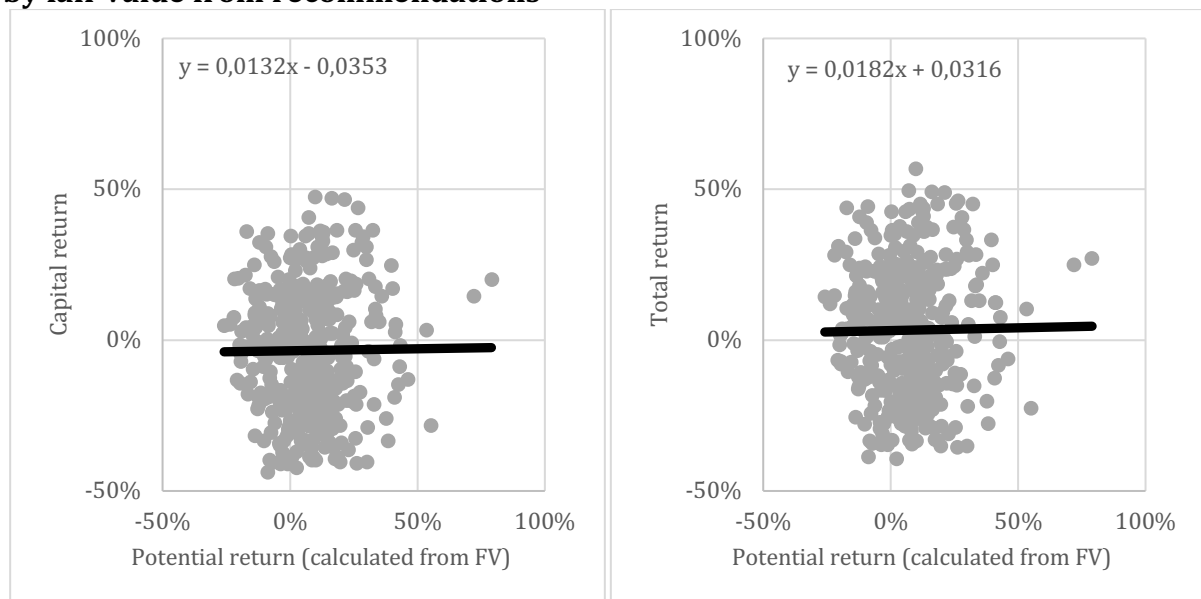
where Δfv is the percentage change in the fair value in two successive recommendations from the same analyst and Δp is the percentage price change in the same period. Similar to the previous regression, α, β are estimated coefficients (intercept and slope) and ε represents the error term. In this formula, we consider only the capital return, i.e. $\Delta p = r_c$. Similar to the previous case, we have the same null and alternative hypotheses; however, in this case we set the significance level to 1% in order to minimize the type I error, which we consider costlier than type II error. With some simplicity we can say that the lower the p-value, the more confident we are in rejecting the null hypothesis.

2. Results of the Research

The observed relationship between potential returns and the observed 1-year returns is depicted in Fig. 3. As can be seen from the figures, there is no obvious relationship between these variables. When we estimate the regression (2) we obtain the parameters shown in Fig. 3 and in Tab. 1. In the table we also record the p-values of the t-test (5). Considering parameter α , we can see that it is significant for both versions of the regression, however its value differs. While considering total return, investors obtained profit on average in analyzed period ($\alpha > 0$). Considering only capital returns, we can conclude that the price was declining on average ($\alpha < 0$). Therefore, we can conclude that the dividend gains play an important role in case of ČEZ, a.s. stocks.

If we focus on parameter β , we can see that its value is small. Actually, due to the high p-values (much higher than chosen significance level 15%), we cannot reject H_0 and accept H_A . Thus, we must accept the null hypothesis (although we have not calculated the value of type II error). This means that either the analyst cannot estimate the fair value correctly or the market is inefficient in pricing the assets. While the efficient market hypotheses are generally accepted and supported by researchers, we can conclude that the first is true and analysts cannot predict the fair value in case of ČEZ, a.s. This means that their recommendations are useless to the investors.

Fig. 3: Dependence between historical 1-year return and potential return imposed by fair value from recommendations



Source: authors' own calculations, data from (Kurzy.cz, 2018a, 2018b; Patria, 2018)

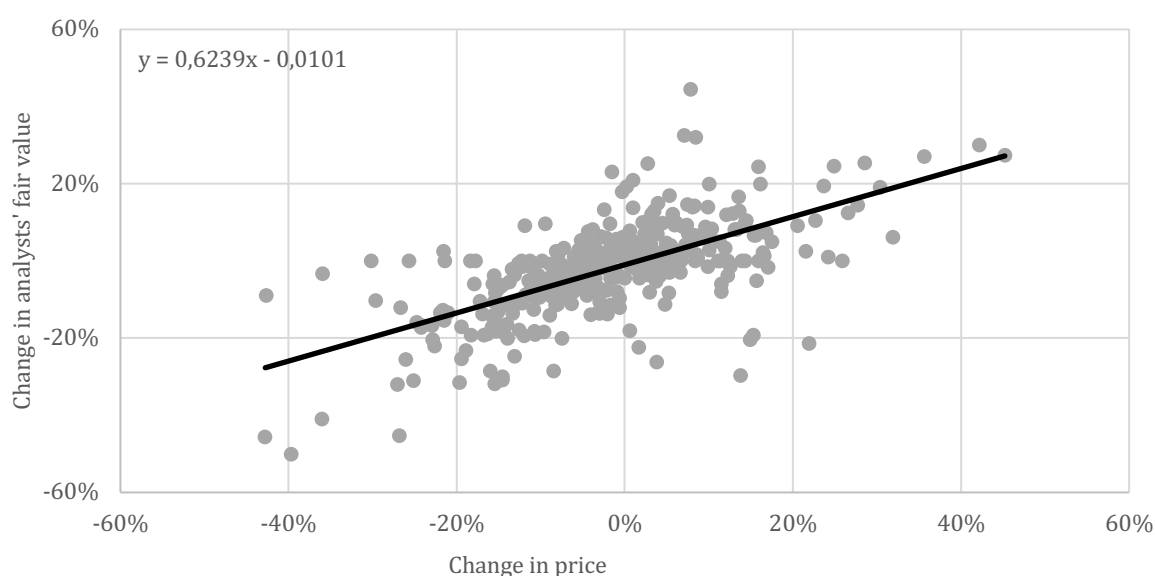
Tab. 1: Estimated parameters of the regressions with corresponding p-values

Regression equation	α	β
(2) – capital return	-0.0353 (p-value 0.002)	0.0132 (p-value 0.850)
(2) – total return	+0.0316 (p-value 0.008)	0.0182 (p-value 0.799)
(6)	-0.0101 (p-value 0.047)	0.6239 (p-value 0.000)

Source: authors' calculations in Microsoft Excel, data from (Kurzy.cz, 2018a, 2018b; Patria, 2018)

As we have found that the analysts' recommendations are useless to the investors, we further analyze how these recommendations are created. Generally, the analysts apply some advanced model, such as dividend discount model or discounted cash-flow model in order to calculate the fair value. For these models, the detailed and accurately forecasted input data are required. In order to provide some benefit to the investors, the analysts should be the first one to accurately forecast the changed input data (i.e. future dividends, future cash flows etc.) and calculate the fair value. Controversially, we can assume that the change in analyst's fair value depends on the price change. Simply speaking, the analysts just take the previous fair-value and adjust it in the same way as the price has changed. We test the regression (6), for which the results are depicted in Fig. 4 and Tab. 1. As can be seen from the results, the change in analysts' fair-values can be explained by the previous change in the price with high confidence – parameter beta is significantly (p-value almost zero) greater than zero and actually it has a relatively high value of 0.624.

Fig. 4: Dependence of change in fair value on change of market price



Source: authors' own calculations, data from (Kurzy.cz, 2018a, 2018b; Patria, 2018)

Conclusion

In the paper, we focus on the study of analysts' recommendations in case of ČEZ, a.s. stock. Concretely, we study the relationship between the potential future returns as predicted by fair values suggested by analysts and truly observed future returns. We find out that there is no relationship between these two returns, which means that the analysts cannot predict the fair value in case of ČEZ, a.s. Their recommendations are useless to the investors. Moreover, we study the relationship between the percentage change of fair value in two successive recommendations and percentage price change in the same period. From our analysis, we can conclude that the change of fair value depends on the price change in the same period. These findings are in line with semi-strong efficient market hypothesis and support this hypothesis.

The research in the paper is focused on the analysts' recommendations in case of ČEZ, a.s. stock only. In the paper, we also focus only on the changes in estimated fair value. The

future research development can be as follows. More stocks traded at Prague Stock Exchange can be considered, then we can study the accuracy of particular analysts. Next, we can focus on the study of price movements after the recommendation upgrade or downgrade.

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Strategic philanthropy and philanthropic strategy

Abstract

Over the recent years, the intersection of business and society have attracted considerable attention of academics and practitioners alike. Much debate arises especially around the question of the impact of corporate philanthropy on the giving business and the receiving society. In parallel with this body of literature, the concept of strategic philanthropy emerged, supporting the strategic use of philanthropy to achieve economic aims and benefit social welfare. The definition of strategic philanthropy has not yet been unified and the theoretical concept of strategic philanthropy can only hardly be verified in practice for the reason of missing methodological tools, however, it should be clearly distinguished from philanthropic strategy. The aim of this paper is to contribute to existing research on the topic of strategic philanthropy by providing an empirical study examining the relationship between strategic philanthropy and philanthropic strategy. As a proxy for philanthropic strategy, this study considers the presence of strategic plan for philanthropic activities in the target group of Czech firms engaged in corporate philanthropy. The engagement in strategic philanthropy is viewed through three proposed features: simultaneous measurement of impact on society and business, appointed philanthropic manager and presence of budget for philanthropic activities in the sense of planned, pre-allocated financial resources for this area.

Key Words

Strategic philanthropy, philanthropic strategy, impact measurement, corporate social responsibility

JEL Classification: M14

Introduction – The distinction between strategic philanthropy and philanthropic strategy

Corporate philanthropy can be defined as a charitable transfer of corporate resources to recipients at below market prices in the form of direct giving of financial assets as well as the in-kind gifts of employee time, goods or services (Maas & Liket, 2011). According to Saiia, Carroll and Buchholtz (2003), corporate giving managers believe that the practice of philanthropy is becoming more strategic. This new approach, called strategic philanthropy, is proposed as a reconciliation of opposing theoretical views demanding for corporate social responsibility (CSR) on one hand and short-term profit maximization on the other hand (Porter & Kramer, 2002; Saiia et al., 2003; Liket & Maas, 2016). Strategic philanthropy thus has a dual objective: to benefit social welfare and simultaneously enhance financial profitability (Saiia et al., 2003; Maas & Liket, 2011; Liket & Maas, 2016). Saiia et al. (2013) see strategic philanthropy as “*giving of corporate resources to address nonbusiness community issues that also benefit the firm's strategic position and, ultimately,*

its bottom line". Seifert, Morris and Bartkus (2003) identified strategic philanthropy as „the label that has been used to describe corporate philanthropy aimed at helping the bottom line." In general, the literature supports strategic use of philanthropy to achieve social benefits and at the same time address Friedman's early concerns over the wealth of shareholders (Friedman, 1970).

The question, however, is, how to verify the strategic philanthropic behaviour in practice. The opinions of researchers are not unified. Many authors see strategic philanthropy behind the motivations of firms for engaging in corporate philanthropy, with the premise that strategic philanthropy has other motives beyond altruism (Campbell & Slack, 2008). Objectives achieved through strategic philanthropy include sales growth (Lev, Petrovits & Radhakrishnan, 2009), corporate reputation improvement (Brammer & Millington, 2005) or customer loyalty enhancement and employee commitment (Chen, Patten & Roberts, 2008). Others see the strategic approach behind the factors influencing corporate giving, e.g. the attitudes of CEO or the board composition (Saia et al., 2003), company size (Chen et al., 2008; Amato and Amato, 2012), industry (Chen et al., 2008; Amato and Amato, 2012), slack resources (Seifert et al., 2003) or business exposure (Saia et al., 2003). Other authors sought the relationship between corporate philanthropy and firm financial performance (Seifert et al., 2003). On the contrary, many authors (Porter & Kramer, 2002; Maas & Liket, 2011; Liket & Maas, 2016) do not consider the motives and self-proclaimed strategic intentions as clear evidence of strategic philanthropic practices. With relation to Smith (1996), Maas and Liket (2011), as well as Ricks and Williams (2005), see the measurement of the impact of philanthropic activities on the society and business as a proof that the firm strives for social and financial benefits simultaneously, thereby fulfils the dual objective of strategic philanthropy. They understand strategic philanthropy as the mixture of the professionalism in the giving function, where philanthropy is treated as any other business activity, and the match between the firm's identity and its philanthropy. Through this view, the measurement of the impact of philanthropic activities represents a signal of strategic approach to philanthropy because this information is crucial to strategic decision-making (Maas & Liket, 2011).

However, it is possible to measure the impact and still not act strategic (Liket & Maas, 2016). The measurement of impact on society and business confirming the dual objective of strategic philanthropy is thus not the only verifiable aspect of strategic philanthropy. Saia et al. (2003) found out that of six presented definitions of strategic philanthropy, the most favoured definition was that based on Smith (1996). The definition states that strategic philanthropy has an empowered giving manager who coordinates all giving activities, identifies the community issues that most naturally mesh with the purpose of the firm, uses the firm's other resources in the giving process and pushes giving activities to all levels of the firm. Other definition, which received significant attention, stresses professionalism in the giving function (Mescon & Tilson, 1987). It points out the importance of assigned giving manager accountable for the performance and evaluation of meeting the objectives. As the corporate philanthropy should be managed as a legitimate business function, it demands appropriate staff or competent consultant (Mescon & Tilson, 1987). Furthermore, in Carroll's model (1979) of corporate social responsibility, a firm's social responsibilities create a hierarchy of economic, legal, ethical and discretionary responsibilities containing corporate philanthropy (Seifert et al., 2003). Strategic philanthropy, however, is situated at the opposite end of the corporate philanthropy spectrum from the altruistic approach (Saia et al., 2003) and according to

Windsor (2006), should be positioned in Carroll's pyramid between corporate citizenship and economic conception. Dienhart (1988) even argues that in this view, charity is consistent to investment. If perceived as such, it demands allocated resources for its activities.

The concept of strategic philanthropy is not unified, but most of the authors agree that it can be described as an action undertaken by firms with the goal of creating social and business benefits simultaneously (Saiia et al., 2003; Maas & Liket, 2011; Liket & Maas, 2016). As such, it should be distinguished from philanthropic strategy (Post & Waddock, 1995; Campbell & Slack, 2008). Generally, strategy represents a plan of action how to achieve long-term goals. As defined by Post and Waddock (1995), who first separated strategic philanthropy and philanthropic strategy, philanthropic strategy means that financial contributions are managed in an orderly way (Saiia et al., 2003; Post & Waddock, 1995). Campbell and Slack (2008) interpreted philanthropy strategy from the voluntary charitable donations policy disclosures from the annual reports of U. K. firms as the disclosure describing intent how the company disburses its charitable giving. These findings imply that firms pursuing strategic philanthropy strive for the social and business benefits, thus should evaluate the results in order to optimize the decision making in this area (Maas & Liket, 2011), while philanthropic strategy represents the process determining how firms resources should be allocated to achieve the philanthropic goals. Although Mescon and Tilson (1987) see the presence of set goals and plans for this area as other aspect of strategic philanthropy, in the concept of this paper, the existence of a strategic plan for this area is considered as a proxy for a philanthropic strategy. The goal of this paper is to determine the relationship between the presence of strategic plan for philanthropic activities, serving as proxy for philanthropic strategy, and engagement in strategic philanthropy. The engagement in strategic philanthropy is viewed through impact measurement, appointed philanthropic manager and budget for philanthropic activities in the sense of planned, pre-allocated financial resources.

1. Methods of Research

The data was collected via an online survey. The target group of Czech companies involved in corporate philanthropic activities was established from the donors listed in the 2017 or 2016 annual reports of non-profit organizations with open public collection for its charity projects on Darujspravne.cz website (Donor correctly). This platform focuses on individual donations to simplify donor engagement with non-profit organizations. Every organization registered at Darujspravne.cz is verified and fully transparent. At the time of data collection, from June to December 2018, there were 260 non-profit organizations with open public collection. The final database of private companies mentioned among corporate donors in these annual reports consists of 2270 entities. The questionnaire link was sent to e-mail addresses of all of these companies. In total, 109 respondents completed the questionnaire (response rate 4.8 %). Descriptive statistics and correlations analyse the proposed aspects referring to engagement in strategic corporate philanthropy. The Pearson χ^2 Likelihood ratio and Phi/Cramer's V were used to determine if there is a significant relationship between the presence of strategic plan and the proposed aspects of strategic philanthropy.

2. Results of the Research

The purpose of the analysis was to determine the relationship between the presence of strategic plan for philanthropic activities in Czech companies (strategic plan is presented; philanthropic activities partly incorporated in corporate strategy; philanthropic activities not incorporated in corporate strategy) and the presence of impact measurement practices (measurement of impact on society (yes/no) and impact on business (yes/no) simultaneously), appointed philanthropic manager (yes/no) and philanthropic budget (yes/no). The descriptive statistics show that the presence of strategic plan for philanthropic activities is quite widespread in the Czech companies (see Tab. 1). The strategic plan is presented in 37 % of firms, 50 % of firms in the sample partly incorporated philanthropic activities in corporate strategy. On the contrary, it confirmed that Czech companies do not use measurement practices very often. Although almost half of the companies in the sample reported an established philanthropic manager and budget, the impact of its philanthropic activities on society measure only 19 % of the firms and the impact on business only 14 %. Only 6 % of companies measure both categories of impact. According to the KPMG Survey of Corporate Responsibility Reporting 2017 (Blasco & King, 2017), the Czech Republic have recorded increase of 8 percentage points between 2015 and 2017 in corporate responsibility reporting. However, it still belongs among countries with corporate responsibility reporting rate lower than the global average (less than 72 %), with the rate 51 % being the last from EU countries except Cyprus. The results show that the companies in the Czech Republic still have a way to go to understand the impact of their philanthropic projects, which is an important aspect of being strategic in philanthropic behavior.

Tab. 1: Overview of descriptive statistics (% , N= 109)

Philanthropic strategy					
Presence of strategic plan for philanthropic activities in the firm					
Strategic plan is presented		Philanthropic activities partly incorporated in corporate strategy		Philanthropic activities not incorporated in corporate strategy	
37 %		50 %		13 %	
Strategic philanthropy					
Presence of measurement of impact on society and business simultaneously		Presence of philanthropic manager		Presence of budget for philanthropic activities	
Yes	No	Yes	No	Yes	No
6 %	94 %	49 %	51 %	49 %	51 %

Source: author

The correlation coefficients between the aspects of strategic philanthropy show that there is a significant relationship between the presence of social impact measurement practises and all other variables ($p\text{-value} < 0.05$ for all the variables), however this do not hold for the measurement of impact on firm's bottom line ($p\text{-value} < 0.05$ for variable impact on society, $p\text{-value} > 0.05$ for variables philanthropic manager and budget) (see Tab. 2). It confirms the generally known assumption that social impact measurement is demanding activity (because of missing methodological tools), which requires experienced professional. Furthermore, it suggests that firms pursuing social impact measurement of

corporate philanthropy may indeed perceive philanthropic activities as investment. The correlation coefficients also show a significant relationship between the presence of philanthropic manager and budget for philanthropic activities (p-value < 0.05).

Tab. 2: Correlation between aspects of strategic philanthropy

	Statistical tests	Impact on society	Impact on business	Philanthropic manager	Philanthropic budget
Impact on society	<i>Phi/Cramer's V</i>	1.000	.223*	.251**	.319**
	<i>Sig.</i>	.	.020	.009	.001
	<i>N</i>	109	109	109	109
Impact on business	<i>Phi/Cramer's V</i>	.223*	1.000	.076	.016
	<i>Sig.</i>	.020	.	.426	.872
	<i>N</i>	109	109	109	109
Philanthropic manager	<i>Phi/Cramer's V</i>	.251**	.076	1.000	.541**
	<i>Sig.</i>	.009	.426	.	.000
	<i>N</i>	109	109	109	109
Philanthropic budget	<i>Phi/Cramer's V</i>	.319**	.016	.541**	1.000
	<i>Sig.</i>	.001	.872	.000	.
	<i>N</i>	109	109	109	109

Source: authors' calculations in IBM SPSS Statistics 22.0

* Correlation is significant at the level 0.05

** Correlation is significant at the level 0.01

Tab. 3: The relationship between presence of strategic plan and proposed aspects of strategic philanthropy

	Statistical tests	Impact measurement	Philanthropic manager	Philanthropic budget
Strategic plan	<i>Pearson χ^2</i>	X	21.435	39.254
	<i>Likelihood ratio</i>	3.668	22.929	43.988
	<i>Phi/Cramer's V</i>	0.187	0.443	0.600
	<i>Sig.</i>	0.148	0.000**	0.000**
	<i>Kendall's tau-b</i>	0.006	-0.425	-0.564
	<i>Sig.</i>	0.959	0.000**	0.000**
	<i>N</i>	109	109	109

Source: authors' calculations in IBM SPSS Statistics 22.0

* Correlation is significant at the level 0.05

** Correlation is significant at the level 0.01

Tables 3 and 4 show the results for the relationship between the presence of strategic plan and aspects of strategic philanthropy. The relationship is statistically significant at the level of importance 0.01 for the presence of strategic plan and the appointed philanthropic manager and budget but is not statistically significant for the impact measurement (see Tab. 3). However, the results differ according to the categories of impact (see Tab. 4). It is evident that there is a statistically significant relationship between the presence of strategic plan for philanthropic activities and the measurement of impact on society. The finding that firms with strategic plan for philanthropic activities more likely measure the impact on society in comparison with the impact on firm's bottom line implies more attention is given to the social cause rather than other objectives which can be achieved through strategic philanthropy.

Tab. 4: The relationship between presence of strategic plan and impact measurement

	Statistical tests	Impact on society	Impact on business
Strategic plan	<i>Pearson χ^2</i>	13.860	0.85
	<i>Likelihood ratio</i>	13.754	0.86
	<i>Phi/Cramer's V</i>	0.357	0.028
	<i>Sig.</i>	0.001**	0.958
	<i>Kendall's tau- c</i>	-0.290	0.024
	<i>Sig.</i>	0.004**	0.793
	<i>N</i>	109	109

Source: authors' calculations in IBM SPSS Statistics 22.0

* Correlation is significant at the level 0.05

** Correlation is significant at the level 0.01

3. Discussion

For many years, corporate philanthropy was an activity through which companies have fulfilled social responsibilities to the local communities (Liket & Maas, 2016). The pressures to add value to the bottom line led to the tension between demands for corporate social responsibility and short-term profit maximization (Porter & Kramer, 2002; Saiia et al., 2003;) and the emergence of strategic philanthropy. This concept has been evolving in the academic literature for last 30 years but there are still lack of studies examining whether companies are really strategic in their philanthropy. Nevertheless, this concept deserves proper exploration. Companies need to use limited resources as efficiently as possible and organizations that do not act strategically in philanthropic activities can lose limited resources or provide fewer benefits. If organizations do not act strategically in their philanthropic behavior, it means that large sums of money and various contributions are consumed without showing what they generated (Maas & Liket, 2011) or whether it could be used more efficiently. If companies, in an effort to strategically decide on their philanthropic contributions to increase the efficiency of resources spent on philanthropy, both in financial and social terms, begin to hire philanthropic managers and evaluate (at least at the basic level) the impact of their philanthropic activities, they can gain important information from their environment and stakeholders, which can be incorporated into strategic decisions. Subsequently, it would be possible to develop more effective strategies in this area and optimize the budget expenses for these activities.

The limiting factor of this research is low response rate of the questionnaire survey. At present, the Czech Republic lacks a register of private companies engaged in corporate philanthropy, so the author constructed it from the donors sections of non-profit organizations' annual reports and manually searched the email addresses. However, large percentage of emails cannot be delivered. The topic can be further developed by examining the influence of impact measuring on strategic development of the company.

Conclusion

This paper contributes to the modern topic of strategic philanthropy by addressing the relationship between the presence of strategic plan for philanthropic activities as a proxy

for philanthropic strategy and the engagement in strategic philanthropy through three proposed features: simultaneous measurement of impact on society and business, appointed philanthropic manager and presence of budget for philanthropic activities in the sense of planned, pre-allocated financial resources for this area. The statistical tests performed on the basis of the results of the questionnaire survey among Czech firms engaged in corporate philanthropy show that there is a relationship between the presence of strategic plan for philanthropic activities and the presence of philanthropic manager, philanthropic budget and measurement of impact on society. However, the relationship is not significant for the impact measurement in the sense of simultaneous measurement of impact on society and business. The results also confirmed a significant relationship between the presence of social impact measurement practises and the presence of philanthropic manager and budget, however this do not hold for the measurement of impact on business.

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Changes in Economic Institutions - Impact of The Great Depression on The United States' Government's Role

Abstract

The paper analyses how an existing institutional framework in a given country might be changed due to a large economic crisis. Economic institutions are the very groundwork that defines the institutional environment in every country. It circumscribes from formal rules that society is bound to follow to informal ones. The paper analyses how the Great Depression and the responsive decisions of the then leaders completely have transformed the government's role, particularly the role of economic policy, in the country's economy. Specifically, the paper examines the time of the above mentioned change of the United States' government's role in terms of its active involvement in the country's economy. The change occurred after the Great Depression, primarily during Franklin Delano Roosevelt's presidency and was performed through a set of reforms known as the New Deal. The paper examines historical data of the United States and their development promptly after the Great Depression. The examined data consist of the government's spending as a part of Gross Domestic Product, Social welfare expenditures and government civilian employment. The rising trend in all three aspects shows how basic economic institution such as the government's role in the economy can rapidly change in relatively short period of time.

Key Words

Great Depression, economic institutions, 1929, New Deal, FDR

JEL Classification: N22, G01, E02

Introduction

The purpose of this paper is to show how a major economic crisis can induce a change in elementar economic institutions. To prove this point, this article focuses on changes made during Franklin Delano Roosevelt (FDR)'s presidency and how they influenced government's role in the economy. For centuries before the Great Depression, the United States' government played a small part in the country's economy except for times of war. But after the Great Depression and the associated New Deal, government's role changed irretrievably.

The partial goal derived from the main purpose of this paper is to examine the impact of a major historical event, the Great Depression, on economic institutions. The United States were the largest economy in the world and were struck hard by the Great Depression. With high unemployment and negative GDP growth, American citizens wanted the government to act. Most reforms influencing United States' institutional environment were enacted 4 years after the event and it is the reason why this paper focuses mainly on reforms made during FDR's New Deal and their influence on institution environment.

Even though the overall efficiency of FDR's New Deal and its impact on United States' economic performance is somewhat questionable their imprint on economic institutions is definitive. (Fishback, 2016)

To be able to examine the impact of the Great Depression on changes in the institutional environment in the United States, it is essential to define the economic institutions. According to Geoffrey M. Hodgson (2003), institutions are "*structures that can constrain and influence individuals*". In other words, economic institutions are established sets of formal and informal rules that are a part of society and/or culture. This paper focuses on changes in institutions caused directly or indirectly by the Great Depression.

The Great Depression, starting in 1929, had a devastating impact on world economics and the United States as an epicentre of this event were especially suffering the consequences. Due to incessant economic downturn and lack of action from the then president Herbert Clark Hoover, voters came to a conclusion that there has to be an intervention implied to help overcome these hard times. FDR promised to make necessary precautions that will help the "*forgotten man*", which was a euphemism for people "*living at the bottom of the economic pyramid*" (Roosevelt, 1932). Following his presidential campaign, FDR got into office in 1933 introducing a series of reforms aiming to cure American economics from the Great Depression's aftermath. FDR's reforms enacted between years 1933 and 1939 came to be known as the New Deal. (Rosen, 2005)

Tab. 1: USA's Economic Indicators 1929-1943

Year	GDP Growth	Inflation	Unemployment
1929	-	0.6 %	3.2 %
1930	-8.5 %	-6.4 %	8.7 %
1931	-6.4 %	-9.3 %	15.9 %
1932	-12.9 %	-10.3 %	23.6 %
1933	-1.2 %	0.8 %	24.9 %
1934	10.8 %	1.5 %	21.7 %
1935	8.9 %	3 %	20.1 %
1936	12.9 %	1.4 %	16.9 %
1937	5.1 %	2.9 %	14.3 %
1938	-3.3 %	-2.8 %	19 %
1939	8 %	0 %	17.2 %
1940	8.8 %	0.7 %	14.6 %
1941	17.7 %	9.9 %	9.9 %
1942	18.9 %	9 %	4.7 %
1943	17 %	3 %	1.9 %

Source: authors' processing based on Amadeo (2018a and 2018b) and Federal Reserve System (2019)

Even though, as it is visible in Table 1, FDR's reforms (see year 1933) brought almost immediate stability into the United States' economy through an increase in government spending, they did not stimulate private sector enough and did not prevent the arrival of another depression in 1938. The only thing which definitely ended the Great Depression's aftermath was military mobilization accompanied by massive government spending in the arms industry, both connected to the outbreak of the World War II. (Fishback, 2016)

Although the New Deal reforms did not bring the anticipated effect on United States' economy, it certainly changed the United States' government's role in the society functioning.

1. Methods of Research

An american economist and a Nobel prize winner Oliver E. Williamson (2000) came with an idea of the institutional hierarchy, as part of his theoretical work in the field of new institutional economics. Williamson (2000) classified institutional change into four categories depending on their frequency and impact on functioning of societies and economies. According to the Williamson's institutional hierarchy displayed in Table 2, the change in government's role can be classified as L2 or change of formal rules of the game.

Tab. 2: Williamson's Institutional Hierarchy

	Level	Frequency (years)	Purpose
L1	Embeddedness: informal institutions, customs, traditions, norms, religion	100 to 1000	Often noncalculative; spontaneous
L2	Institutional environment: formal rules of the game –esp. property (polity, judiciary, bureaucracy)	10 to 100	Get the institutional environment right. 1st order economizing
L3	Governance: play of the game – esp. contract (aligning governance structures with transactions)	1 to 10	Get the governance structures right. 2nd order economizing
L4	Resource allocation and employment (prices and quantities; incentive alignment)	Continuous	Get the marginal conditions right. 3rd order economizing

Source: Williamson (2000)

As mentioned in the previous section, the purpose of this paper is to show how one president's reforms can influence institutional environment of a whole country. In order to do that, this paper examines United State's historical data concerning government spending, government employment and their development after the Great Depression and during FDR's presidency. The collected data are analyzed and processed in a way that it is possible to interpret trends in United States' government's involvement, concerning how it changes its approach towards solving the crisis and government's overall participation in the country's economy. Larger government involvement meant that there were new ways and new legal framework influencing the day to day lives of America's citizens and it especially projected onto business environment and economic output. (Hodgson, 2003)

2. Results of the Research

Federal government's role in American society changed rapidly with the increase of government spending, see the table below. Over the previous centuries, government's spending was variously changing depending mainly on whether the country was at war and needed to mobilize or at peace trying to pay off national debt. (Fishback, 2016)

Tab. 3: The USA's Government spending as part of GDP 1929-1943

Year	Government spending as part of GDP
1929	3 %
1930	4.1 %
1931	5.3 %
1932	7.2 %
1933	8.9 %
1934	8.9 %
1935	10.2 %
1936	10.8 %
1937	9.5 %
1938	9.7 %
1939	9.9 %
1940	9.8 %
1941	10.9 %
1942	21 %
1943	41 %

Source: author's processing based on USGovernmentSpending (2018) and Federal Reserve System (2019)

Before the Great Depression, it was usual for the government to be mainly an administrative unit, whose concern was taking care of public property (e.g. roads), restoration of law and order and dealing with national defense (Hiltzik, 2011). This is the prime reason why the United States' government's role in the economy was estimated to be less than 3 % of GDP in years foregoing the Great Depression (Fishback, 2016). Contents of Table 3 suggest that the government, through series of fiscal expansions, grew bigger every year, notwithstanding there was no war promptly after the recession. This means that government participation on America's economy changed and there were consequences for institutional environment as well.

The most influential change in United States' economic institutions was the change that made people think differently about the government's role. Before the New Deal, citizens of America did not expect the government to help them with their problems and were taught that everybody has to take care of themselves. After the New Deal, there was no more question whether or not the government should act in case of economic discomfort of its citizens, but the new question was (and still is) how it should act. (Hiltzik, 2011)

As said before, government's role in the economy shifted after the Great Depression and the following New Deal. The alteration was from government being an organization whose primary goal was to take care of national defense into an organization taking care of its citizens' wellbeing on a large scale. Social Security Act enacted in 1935 was the first attempt to establish a social welfare system in the history of the United States and up until today it is considered to be one of the biggest government reforms leading to a change in institutional environment.

Tab. 4: The USA's Social Welfare Expenditures Under Public Programs 1929-1940 and in selected years

Year	Social Welfare Expenditures (in millions of dollars)	Social Welfare Expenditures as part of GNP	Social Welfare Expenditures per capita
1929	3 921	3,9 %	32
1930	4 085	4.2 %	33
1931	4 201	5.1 %	33
1932	4 303	6.4 %	34
1933	4 462	7.9 %	35
1934	5 332	9.7 %	46
1935	6 548	9.5 %	51
1936	10 184	13.2 %	79
1937	7 858	9.1 %	60
1938	7 924	9.0 %	60
1939	9 218	10.5 %	70
1940	8 795	9.2 %	66
1950	23 508	8.9 %	158
1960	52 293	10.6 %	286
1970	145 893	15.3 %	701

Source: author's processing based on US Bureau of The Census (1975)

According to the US Bureau of The Census (1975) data summarized in Table 4, it is obvious that there is a growing trend in social welfare part in the economy of the United States. Over the decade following the Great Depression, government expenditures on social welfare calculated in per capita almost doubled as a result of FDR's generous policies focused on unemployment compensations, support for the handicapped and other forms of reliefs for youth, erderly or stranded rural communities. As the data in Table 3 suggest, FDR's New Deal was just the beginning of government participation in subsidizing poor and infirm and in the following decades, people's dependence on social welfare only strengthened. US Bureau of The Census (1975)'s data also mention that social welfare expenditures as percentage of all government expenditures slightly increased over time (except for war times). Social welfare costs, as a fraction of United States' government budget, have risen from 36,3 % in 1929 to 49 % in 1940, but in the following decades, as the United States economy got out of the wave of recession, it de-escalated back and moved around 40 % of all government expenditures.

During Hoover's presidency, the number of public employees (employees of the Central Intelligence Agency and the National Security agency excluded) changed only slightly. After FDR got into presidential office in 1934, he established a number of programs. So-called alphabet agencies included e.g. Civilian Conservation Corps (CCC), Social Security Administration (SSA), Works Progress Administration (WPA), National Recovery Administration (NRA), Public Works Administration (PWA) and dozens more. Most of the agencies had a simple goal of creating jobs through public procurement, for example, CCC created approximately 2,75 million jobs for young men in forest industry and PWA paid \$3.3 billion to private companies realizing 34 599 construction projects enhancing country's infrastructure (Smith, 2009). Nevertheless, the government also needed to man

these agencies. Under FDR's leadership, the number of civilian public employees rose from 3,2 million in 1933 to 4,25 million in 1940 which equals to over 30 % increase. As the numbers in Table 5 show, this trend only continued over time.

Tab. 5: US Government Employment 1929-1940 and in selected years

Year	Federal Civilian Employment	State and Local Government Employment (in thousands)	Total Civilian Public Employees
1929	579 559	2 532	3 111
1930	601 319	2 622	3 223
1931	609 746	2 704	3 313
1932	605 496	2 666	3 271
1933	603 587	2 601	3 204
1934	698 649	2 647	3 345
1935	780 582	2 728	3 508
1936	867 462	2 842	3 709
1937	895 993	2 923	3 818
1938	882 226	3 054	3 936
1939	953 891	3 090	4 043
1940	1 042 420	3 206	4 248
1950	1 960 708	4 087	6 047
1960	2 398 704	6 083	8 481
1970	2 981 574	9 830	12 811

Source: author's processing based on US Bureau of The Census (1975)

3. Discussion and Conclusion

Under FDR's presidency, United States' government rapidly expanded increasing its spending alongside with number of its employees (military personel excluded). Question is, how would change government's role in the economy, if there was no Great Depression, or if there was no FDR. Would it expand either way, or was it the ultimate catalyst which made it possible? In recent years, United State's government made around 40 % of country's GDP (USGovernmentSpending, 2018; Federal Reserve System, 2019), which inclines high level of redistribution in the economy. There is a possibility that, if the Great Depression was cured in different and more efficient ways (for example through monetary expansions as Milton Friedman suggested (1978), economic institution of government would not have to be changed at all. There is also a possibility that the New Deal and the change in United State's institutional environment connected to it was not necessary at all and the Great Depression could be cured in time either way.

As the data collected and examined in this paper imply, the Great Depression was a spark which initiated the trend of United States' increased government participation in the country's economy. And FDR was the man who made it possible through a number of reforms known as the New Deal. Changes in institutional environment, such as the government's role, examined in this paper, are usually connected to big events (Williamson, 2000). The event which started and inspired change this large and

influential on the United States' institutional environment has not been seen for decades foregoing the Great Depression. The events with comparable impact could be American civil war (1861-1865) and the 1973 Energy crisis. Events like these completely redefine the institutional environment, they bend and shape the rules of the game that economic subjects follow.

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Regional Development Potential: How to Define and Evaluate it in an EU context?

Abstract

Development potential and differences in performance of the territory in the context of cohesion and competitiveness is an issue that is frequently discussed in the European Union, but there is no uniform theoretical approach and consensus on their assessment. The paper aims to analyse the existing approaches to the development potential of the European territory. Besides the analysis of mechanisms and factors that contribute to regional differentiation, the fundamental research question is how to evaluate the level of development potential and its trends. However, no analysed the theoretical and methodological approach to the development potential of the European territory can be considered universal, which makes it impossible to implement common development strategies for all regions. The question is, what strategy is used to increase the effectiveness of regional development policies impact the shift in the economic structure of territory? Regional development strategies should be based on the sound assessment of regional resources, capabilities, competencies and core competencies, as well as on dynamic capabilities aiming to develop the resource configurations to form regional competitive advantage. Based on the literature review, the territorial development and its potential are mostly examined at the level of regions (NUTS 3) or rural areas. In most of the studies is concluded that regional development should be the view from different perspectives taking into consideration not only economic but also social or environmental conditions. Exogenous and endogenous factors determine the potential of regional development, and it is necessary to use quantitative and qualitative indicators to its evaluation.

Key Words

The European Union, development potential, methods, regional development, territory

JEL Classification: C31, C80, O18, R11, R12

Introduction

Since half of the 90s of the 20th century, the European Union (EU) has to face new global challenges, especially the lack of competitiveness in comparison with the other big global economic actors as the United States or Japan. Inequalities, development potential and performance of the European territory (country, region, local unit) in the context of the cohesion and competitiveness has become an important issue that is frequently discussed in the EU, see, e.g. Melecký (2015), Staníčková (2013). The problem of insufficient economic growth, social welfare and competitiveness of the European territory has been intensified since 2004 (later on 2007 and 2013) when central-east European and Balkan countries join the EU. The elimination of socio-economic differences at all territorial units became a primary interest of the Member States because they have been considered as a major obstacle to the balanced and harmonious development of the EU territory. In the

European concept, the level of disparities can be regarded as a measure of cohesion. According to Molle (2007), cohesion can be expressed as a level of differences between countries, regions or groups that are politically and socially tolerable. Compared to differences at the national level, regional disparities have been substantially greater and present negative factors for EU development.

In recent years, the issue of territorial imbalances in the EU has been examined in numerous studies using a variety of different approaches. There are various reasons for the amount of interest surrounding this issue. Among them is the fact that economic growth theory has significantly advanced over the last decades, another is the need to reduce the existing differences in terms of development across the various European regions, an issue closely linked to some of the basic principles that have inspired the construction of the EU (Ezcurra et al., 2005). Indeed, one of the specific assumptions of the European integration is that it will drive the growth of all the EU Member States, and thereby lead to economic, social and territorial cohesion. In the EU, the level of regional development differs across countries, and especially regions. Assessment of regional disparities (mainly at the level of NUTS 2 regions) and identification of key development factors that may contribute to increasing the dynamics and development potential, is crucial to adopt the measures supporting the long-term growth of regional economies. The EU's internal diversity and inequalities are reflected in the quality of living standard, different pace of development of the European territory and also spatial organisation of economic and social activities. In this context, it is necessary to analyse the possibilities and seek new directions of development (considered the hard and soft location factors leading to the long-term territorial development) that can contribute to increasing the dynamism and development potential of economies, see. e. g. Poledníková (2017), Sucháček (2015), Slach et al. (2008). Thus the usage of resources by a given area is a crucial prerequisite for its successful existence in global competition. Territory with lower levels of disparities and a high level of cohesion achieve higher levels of competitiveness and development potential. The paper aims to analyse the existing approaches to the development potential of the European territory and to identify the critical factors to the evaluation of development potential. This paper is based on literature review approach investigating research works on the issues of regional development and components of potential concept to obtain a general overview for evaluating the EU regional development potential.

1. Regional Development

“How do regions grow?” “Why do some regions grow more rapidly than others?” “Why are differences in levels of social welfare across regions so persistent?” These questions have attracted the attention of a diverse group of scholars during the past fifty years. This growing interest in regional development studies is due in part to the recognition that the processes driving innovation and national economic growth are fundamentally spatial (“space matters.”) (Dawkins, 2003, p. 132). Regional economic development may be viewed as both a product and a process but often not by the same groups or actors in the development milieu. For example, economic agents that live, work and invest in regions are those most concerned with economic development outputs or products such as job and wealth creation, investment, quality of life or standards of living and conditions of the work environment. Contrary to this is the more process orientation of regional scientists,

development planners and practitioners where concern focuses on the creation of infrastructure, labour force preparation, human capital and market development. So it is essential when considering regional economic development to maintain an awareness of its product and process aspects.

Regional economic development also is known in terms of quantitative and qualitative attributes. In this context, concerning the benefits it creates, the concern is with the quantitative measurement of such factors as increasing/decreasing the wealth and income levels, job creation or employment levels, the availability of goods and services and improving financial security. At the same time, concern also lies with such qualitative considerations as creating more significant social and financial equity, in achieving sustainable development, in creating a spread in the range of employment and gaining improvements in the quality of life in a region. Thus regional economic development needs to be informed by both quantitative and qualitative information. (Stimson and Stough, 2008, p. 2-3).

Over the past two decades or so, the emphasis in regional economic development theory has shifted from a focus on exogenous to an increasing focus on endogenous factors. Traditional regional economic development approaches were erected on neoclassical economic growth theory, based mostly on the Solow growth model (1956, 2000). The new approaches, while recognising that exogenous factors frame development, understand a much more significant role for endogenous forces. In this context, a suite of models and arguments that broadly convey the new growth theory are directed towards endogenous factors and processes. Those factors are seen as fundamental drivers of regional economic development arising from the resource endowments and knowledge base of a region. Endogenous factors include entrepreneurship, innovation, the adoption of new technologies, leadership, institutional capacity and capability, and learning. These developments are of great interest to regional economic development analysts and practitioners for several reasons, including the recognition of the importance of regions in the development process and also because they introduce an explicit spatial variable into economic growth theory, a mostly ignored element in neo-classical thinking. This evolutionary development is particularly significant as the importance of regions in national economies has changed considerably since the 1970s as a result of globalisation, deregulation, and structural change and adjustment. Understanding these newly recognised processes of change is crucial for analysing and understanding different patterns of regional economic performance and in formulating and implementing regional economic development planning strategy. Stimson and Stough (2008) observe that it is often tricky in regional economic development planning strategy formulation and implementation to match desired outcomes of regional economic development with the processes that create them. This gap in understanding the relationship between the apparent causes and effects of development pose a dilemma for those responsible for managing regional economic growth in the making of policies and strategies, and their implementation of plans. The difficulty they face is how to achieve some form of congruence between desired outcomes and appropriate and acceptable economic development tools and processes. This dilemma is further compounded by the frequently unstable and changing nature of economic environments, where 'externalities' or exogenous factors (such as exchange rates, new technologies, foreign competition) increasingly impact the decision-making processes that influence economic policy and strategy in regions.

2. Concept of Development Potential

The term development can be defined as the process of positive quantitative or qualitative changes. The development has several dimensions from multinational, through regional to a local level (Ďurková et al., 2012). Regional development is a complex of processes taking place in the regions that affect economic, social, environmental and other changes of a region. Regional development involves economic as well as social and ecological development providing excellent conditions for increasing regional cohesion and competitiveness. 'Socio-economic development of the area is based on an effective regional policy, which requires a different kind of resources composed in total the potential of the region' (Cheymetova and Nazmutdinova, 2015, p. 74). Broadly, the term potential can be considered as a source of opportunities, resources, stock, which can be activated, used to solve a problem or achieve a specific goal; capabilities of the individual, society and state in a particular field (Cheymetova and Nazmutdinova, 2015). 'Combined expression of the material base of the region should be considered economic potential, take into account not only the volume located within a given territorial unit property, expressed in various quantitative indicators but also the qualitative characteristics that determine the potential of the region. The aggregate potential of the territory must be considered, first of all, the socio-economic, as the research of any kind components of only the economic potential of the region will inevitably lead to the inclusion of the social dimension, which characterizes the relationship between the people on the creation, development and effective use of resources in the region' (Cheymetova and Nazmutdinova, 2015, p. 75). Baksha et al. (2001) understand the concept of potential as a system of material and labour factors (conditions), ensuring the achievement of the purposes of production, and an opportunity through the use of resources to solve complex tasks entrusted to it. Moreover, Svobodin (1991) considers potential as a set of co-operating resources with the ability to produce a certain amount of production (Cheymetova and Nazmutdinova, 2015). Then, economic potential can be seen as 'the capacity for growth and development that has a geographic space as a result of a combination of factors, geographical, historical, economic, institutional and social' (Rivera, 2012, p. 466).

The regional resource potential can be divided into three related blocks: environmental, social and economic potentials (Safiullin et al., 2016). The environmental potential includes natural resources, which can be theoretically available for use. The social potential represents a set of capabilities (social infrastructure as housing, education, health care, culture, etc.) available to the territorial unit to ensure the most favourable conditions of life of the population. The economic potential is largely determined by its social and environmental components and reflects the level of the region's productive forces development, its ability to produce goods, perform work and provide services. According to Ďurková et al. (2012) factors influencing the economic level of regions are localization of enterprises in the region and their frequency, branch structure, economic stability; the intensity of intra-regional economic relations, types of organizational forms; quantitative and qualitative characteristics of the population and its movement; technical and social infrastructure in terms of complexity, quality and quantity; the available natural resources and their utilization rate; direct and indirect impacts of the state economic policy. Crescenzi and Rodríguez-Pose (2012) or Čingule (2009) highlights technical infrastructure, especially transport infrastructure as the main alternative for raising the economic potential and promoting territorial cohesion, as well as social

structure and development of entrepreneurship. The importance of business also confirms, e.g. Gods et al. (2007) whereas the assessment of business potentials should include an audit of the regional industrial and institutional structure building the basis for the regional innovation system. In general, territorial development and solution of regional problems is determined by exogenous and endogenous factors that influence the potential of local development as endowment, resources, human and social capital, accessibility, infrastructure etc. (e.g. entrepreneurial skills, local production, technological progress, the diversity of industry, the regional specialization, quality of local actors/institutions, innovation, knowledge, creative potential of population, learning networks, physical proximity, agglomeration advantages), see e.g. Antonescu (2015), Capello and Perucca (2015), Raszkowski and Głuszczyk (2015), Jóna (2015), Dańska-Borsiak and Laskowska (2014).

3. Evaluation of Development Potential

There is several economic, social or environmental factors and indicators that can be used to assess territorial development potential and performance in the EU. Although the phenomenon of development has been discussed by many researchers, academics, authorities and institutions for decades, there is no uniform theoretical approaches and consensus on the measurement and assessment. Evaluation of the level of development, its potential and main determining factors is the most important conditions for developing the regional development policy in an effective and effectiveness way.

Various factors are influencing the level of development and number of indicators that can be used for the assessing of development potential, growth and performance of a given territory. Regions differ mainly on the economic level, based on Ďurková et al. (2012), this level is affected by the following factors: localization of enterprises in the region, their frequency, branch structure, economic stability, the intensity of intra-regional economic relations, types of organizational forms; quantitative and qualitative characteristics of the population and its movement; technical and social infrastructure in terms of complexity, quality and quantity; the available natural resources and their utilization rate; and direct and indirect impacts of the state economic policy. Viturka (2014) evaluates the development potential of regions in an integrative way, from factual (integration of economic, social and environmental factors) as well as spatial (integration of territorial structures) perspectives. According to Boryczko (2007) to achieve successful regional development three components are necessary, i.e. genius loci or spirit of the place (economic and academic traditions, natural conditions, business climate, liability, physical attractiveness, human capital, competition with other regions); tangible assets established by people in terms of technical, educational, social infrastructure and economic base (educational institutions, transportation, telecommunication, R&D framework, technical infrastructure, economic structure); regional strategy and all efforts enhance the development (relationships between academic and business circles, cohesive strategy of regional development, grassroots initiatives, partnerships among public, private and non-profit players). Capron (2002) deals with the importance of capital for regional development and differs natural, productive, creative, human and social capital. Cheymetova and Nazmutdinova (2015) describe the structure of the socio-economic potential by four basic approaches, while three approaches have common elements as labour and natural resources, population, production or infrastructure. The fourth

approach reflects the best the possibility for a comprehensive assessment of the socio-economic potential of the area and highlights the availability of resources, their use and also reflected the willingness of the region to economic reform and development.

An approach based on Baksha et al. (2001) reflects the best possibility for a comprehensive assessment of the potential of regional development. This approach highlights all the necessary conditions: the availability of resources, their use and also reflected the willingness of the region to economic reform and development. The first part continues natural resources, economic and geographic and demographic, as they fully reflect the resource base of the region – the availability of natural resources, their reserves, the climatic zone of the territory; reproduction and population of the region; the existence of transport infrastructure and the density of economic activity. The second part consists of the labour potential, which reflects the region's enterprises providing human resources and their effective use; production potential – the existence and development of the power industry, production of their products; social and infrastructural potential determines the conditions and quality of life of the population, i.e. the development of vital infrastructure. Budgetary potential, showing the change only the revenue and expenditure of the regional budget, is supplemented by financial content. The third part carrying out the processes for development of territory is not possible without the willingness of the population of this region, so this unit is turned on intellectual and volitional capacity, reflecting the level of professional development of the society, its ability for sustainable choice of objectives and activities to implement Melecký (2017b).

There are several indicators of regional development potential that are processed by different theoretical (e.g. analysis, synthesis, induction, deduction) or empirical scientific methods and specific quantitative methods of research. Safiullin et al. (2016) combine analysis and synthesis to conduct the component decomposition of the regional resource potential. In the issue of assessment of the level of potential socio-economic development, it prevails the aim to obtain aggregated (integral, synthetic) index (indices) that characterises the analysed territory in a comprehensive way (Cheymetova and Nazmutdinova, 2015). Rivera (2012) compiles an index of regional economic potential to measure the regional economic strength and model is based on several variables of population, work activity, unemployment rate, activity rate, production and income. Capello and Perucca (2015) compute indicator of openness that arises from a principal component analysis on five relevant indicators: attraction of foreign labour, integration of a region with global networks, presence of value-added functions, attraction of international high-value features and attraction of extra-EU capital. Mišek and Nowak (2015) employ Krugman index of dissimilarity to identify potential regional specialisations. The index is calculated based on a comparison of the economic structure of a given region with the average economic structure of the remaining regions. Krugman index was also used by Muštra and Škrabi (2014). Viturka (2014) evaluates the development potentials of regions based on the synthesis of three components: business environment quality, the innovation potential of companies and use of human resources, which stimulate each other. The synergic effects that are generated enhance territorial integration and increase development potential and competitiveness, which creates the basic prerequisites for sustainable regional development.

Very frequently used approach to the measurement and evaluation of the socioeconomic development represents composite indices. The construction of composite indices of

development summarizes, e.g. Santos and Santos (2014). Meyer et al. (2016) constructed a composite regional development index that successfully measures all the dimensions of development quantitatively. In the EU there are some examples of composite indices that contribute to regional development potential evaluation differently, see Melecký (2017a). Other authors use less or more sophisticated statistical methods and econometric models. Crescenzi and Rodríguez-Pose (2012) compile two-way fixed-effect (static) and GMM-diff (dynamic) panel data regression estimations to analyse what extent transport infrastructure endowment across regions of the EU is a fundamental determinant of regional economic growth and territorial cohesion. Makkonen and Inkinen (2013) use panel data and different European regional scales analyse with Granger causality tests. Bal-Domańska (2013) uses a panel model to measure the intensity and direction of mutual relations among the three pillars (smart specialisation, creativity, innovation) and economic cohesion. Agha et al. (2010) introduce conditional-convergence econometric model combining both dynamics – spatial and temporal to investigate whether the EU Cohesion Policy and the structural funds this policy mobilises, affect the European economies in such a way that the more deprived regions catch up with the rich ones.

Conclusion

Detailed analysis of literature references was focused primarily on the territorial unit, factors/indicators and methods used in the issue of the territorial development potential representing the multidimensional process. Most of the authors point out that the regional development should be the view from different perspectives taking into consideration not only economic conditions but also social or environmental as well as exogenous and endogenous factors (characterized by quantitative and qualitative indicators). Some common factors/indicators describing the development potential and growth of the European territory can be identified: research and development, innovation, entrepreneurship, human capital, creative potential, learning networks, infrastructure (financial, social, economic, technical), regional specialisations, geographical proximity, etc. Most studies use comprehensive quantitative approaches to the assessment of the socio-economic potential of territory applying the statistical method or econometric models. After analysing the number of approaches to assess the territorial development potential and growth, it can be concluded that no one of the theories, available methods and indicators can be considered as universal. Measurement of territorial progress with regards to achieving the developmental potential plays a crucial role in improving the prosperity and quality of life in any territories. This process has proved difficult as contemporary views on the measurement of territorial development are multidimensional concepts. Review of approaches to structuring the potential of regional development is made, based on which the methodological tools are selected that allows in further research to create a comprehensive assessment of the EU specific regions at NUTS 2 level by constructing the own composite index.

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Price elasticity in the market of accommodation services - empirical study in Berlin, Warsaw and Prague

Abstract

The submitted paper focuses on the issue of price elasticity of demand for accommodation services between 2014 and 2018. The measurement of price elasticity is performed using a log-log regression analysis. This paper focuses on the markets in the capitals of Germany, Poland, and the Czech Republic, because these markets often have a similar customer base and represent exciting destinations for tourists to Central Europe. One of the results of this paper is that the demand for accommodation services in all monitored destinations is inelastic. This means that a percentage change in price leads to less than one percent change in quantity demanded. This price inelasticity can be a significant indicator of how to change prices in the markets in general so that companies can increase their revenue. The research also shows that we can follow a decreasing trend of price elasticity in the long term. In the past two years, we can also argue that Berlin is showing an increase in the price elasticity of the demand, thus distinguishing it from the other two markets. The results of this research provide background for further analysis and also as input for a detailed study of consumer behavior. Understanding this fundamental feature of consumer behavior (i.e., price-sensitivity) is absolutely necessary for the correct pricing, which is the primary prerequisite for the market of accommodation services to enable companies to increase their expected revenue.

Key Words

price elasticity, demand, accommodation, revenue management

JEL Classification: D12, C20

Introduction

This paper is focused on the issues of measuring the price elasticity of demand in selected markets and destinations. The paper is measuring the price elasticity of demand on accommodation services in Berlin, Warsaw and Prague. This issue concerns the comparison of three locations, which are very important and non-replaceable for Europe in terms of tourism. The objective of this paper is to measure the level of price elasticity of demand in the market of accommodation services in mentioned destinations between 2014 and 2018 and determine whether this market is price-elastic. The results of this measurement shall be used firstly for comparison of selected destinations and the introduction of methodology that is appropriate for measuring the price elasticity.

The analysis of demand allows to identify changes in the quantity demanded when changing sales price, as well as customer's behavior. Therefore, the price elasticity of

demand has a direct impact on the price of products sold, as well as on the performance of accommodation facilities (Du et al., 2016). The basic models used to determine the price elasticity of demand in tourism publications include (1) linear and non-linear demand functions (Lee et al., 2011), (2) logistic regression (Talluri et al., 2004), possibly (3) multiple logistic regression (Anderson et al., 2016; Ratliff et al., 2008). All these models are based on dynamic product valuation not only for individual customer segments but also for the occupancy of the accommodation facility and time horizon (Guizzardi et al., 2017; Oses et al., 2016). The term of price elasticity about demand was defined by Alfred Marshall and is based on the approach of the Cambridge School of Economics (Marshall, 1997). A general approach to measuring the price elasticity is described, for example, by Kirschen et al. (2000) or Kanjilal and Ghosh (2017) - but these approaches are primarily used in the industry. In the sector of services, or directly in tourism, the use of such measured price elasticity of demand is used less frequently. However, such an application may be encountered. For example, Houthakker and Magee (1969) use the approach of monitoring consumer behavior on the market using data from over 200 companies. In this paper, the price elasticity is measured using regression analysis, which makes this paper significantly different from other similar ones.

As research focuses solely on measuring the price elasticity of demand in one city, it is difficult to find similar research studies. The nearest one is, for example, an application in South Korea (see Ahn et al., 2018). Tran (2015) is working with a model of demand for luxury hotels in the United States, taking into account the income level for the selected source country, the average daily cost per day, and also the exchange rate. The results of price elasticity range between -0.03 (in the long term) and -0.02 (in the short term). Hiemstra et al. (1993) measure the price elasticity of demand for accommodation facilities of lower price categories (-0.35) and higher price categories (-0.57). Canina et al. (2005) focus on the price elasticity of demand for accommodation facilities from “economy” to “upper upscale” category (this structure is taken from STR Global). Their results show that the price elasticity decreases with the rising category of accommodation facilities (the price elasticity for luxury accommodation facilities is close to zero). Damonte et al. (1998) focus on measuring the price elasticity and its comparison among selected US territories in low and high season (measured by occupancy). Measured values are between -0.8 and -1.8 for Columbian County, and then between -0.1 and -0.3 for Charleston County.

1. Methods of Research

In this paper, we focus mainly on the issues of measuring the price elasticity of demand in selected markets. Elasticity (η) in general can be expressed by the following relation

$$\eta_x = \frac{\partial Y / Y}{\partial X / X}, \quad (1)$$

where coefficient X is the value whose elasticity is measured on variable Y . Therefore, any variables and their interactions can be measured in elasticity calculations. In this paper, we focus solely on the price elasticity of demand, i.e. the question of how the change in

price affects the quantity demanded on the given market. Thus, we mathematically solve the following relation:

$$\eta_{pd} = \frac{\partial Q / Q}{\partial P / P}, \quad (2)$$

where η_{pd} is the price elasticity, P is the price and Q is the quantity demanded. In general, measurement of the price elasticity is the issue that has several possible solutions from a methodological point of view. In addition to the traditional measurement described above, the measurement can also be made using arc elasticity or elasticity measured at a point using a partial derivative as expressed by the following relation:

$$\eta_{pd} = \frac{\partial Q}{\partial P} \times \frac{P}{Q}, \quad (3)$$

Regression analysis approaches can also be used. Arc elasticity is too general for measurement, and it is not appropriate for large data volume. On the other hand, measurement of elasticity at a point is much more accurate, but not appropriate for general determination of price elasticity. For these reasons, it is preferable to use a regression analysis approach. A simple log-log regression analysis approach will be used to determine the appropriate coefficient of price elasticity of demand. In this logic, the theoretical regression function is determined as:

$$\log Q_i = \beta_0 + \beta_1 * \log P_i + \varepsilon_i, \quad (4)$$

where Q_i is the quantity demanded, P_i is the respective average price for the quantity demanded i . The values of β_0 and β_1 are the parameters of the theoretical regression function and ε is a random error. Thus, the demand function will be expressed as a function of quantity. We will estimate this theoretical regression function to obtain an empirical regression function:

$$\log Q_i = b_0 + b_1 * \log P_i + e_i, \quad (5)$$

where the estimate of the parameter β_1 , i.e. b_1 is the slope of the estimated regression empirical function and thus the coefficient of price elasticity of demand. The OLS method will be used for the solution and it is possible to state that the function B exists

$$B = \sum_{i=1}^n (\log Q_i - b_0 - b_1 * \log P_i)^2, \quad (6)$$

whose solution is under conditions

$$\sum_{i=1}^n e_i^2 = \sum_{i=1}^n (\log Q_i - b_0 - b_1 \log P_i)^2 \text{ K min.} \quad (7)$$

which corresponds to the following solution:

$$\frac{\partial B}{\partial b_0} = 2 \sum_{i=1}^n (\log Q_i - b_0 - b_1 * \log P_{1i}) * (-1) = 0, \quad (8)$$

$$\frac{\partial B}{\partial b_1} = 2 \sum_{i=1}^n (\log Q_i - b_0 - b_1 * \log P_{1i}) * (-x_i) = 0, \quad (9)$$

For the parameters b_0 and b_1 applies that

$$b_0 = \overline{\log Q} - b_1 \overline{\log P}, \quad (10)$$

$$b_1 = \frac{\frac{1}{n-1} \sum_{i=1}^n (\log P_i - \overline{\log P}) * (\log Q_i - \overline{\log Q})}{\frac{1}{n-1} \sum_{i=1}^n (\log P_i - \overline{\log P})^2}, \quad (11)$$

Although the objective is not to estimate the whole regression function, but only its coefficient b_1 , the complex outputs will be presented, especially in order to evaluate the whole model. Its evaluation will be done using r^2 determination coefficient.

In order to obtain the necessary results in this paper, there is available data between 2014 and 2018. This data includes data on the quantity demanded and the average price in the accommodation segment in Prague, Berlin and Warsaw. The data include only traditional accommodation facilities (so-called collective accommodation facilities), i.e. data outside the so-called sharing economy - data are available from more than 600 facilities within collective accommodation facilities. The uniqueness of this data lies in the fact that data is available on a daily basis. This data was obtained and adjusted in cooperation with STR Global Inc. However, in order to measure the price elasticity using the method mentioned above (i.e. log-log regression analysis), it was first necessary to adjust the obtained data to be appropriate for the analysis. It is essential to realize the fact that the data (especially the average price) reflect the decisions of companies in the current market situation. If we want to measure the price elasticity of demand, it is necessary to work with such data that is not affected by extremes at a given moment (such as data at the end of a calendar year or significant events that are held at a given moment). This adjustment can be made using two options. One option is to purge the high values by extremes, for example, using the Grubbs test. These statistical approaches are particularly useful when we do not know more information about the statistical file (only its distribution is known). However, because the analyzed market is known to us, this data will be adjusted based on another logic. Data adjustment is based on the assumption that, with extremely high or meager value added (profitability) of services sold by traditional mass accommodation facilities, the decision on price is influenced by several factors rather than just the quantity

demanded. This is the same logic of decision-making of the company as described in the behavior of the company in duopoly or cartel. Firstly, it is necessary to find an indicator that assesses the profitability of the service sold in the market. For this purpose, the *RevPAR* (Revenue per Available Room) indicator was calculated for each day based on the values obtained, and which was determined as follows

$$\text{RevPAR} = \text{Occ} \times \text{ADR}, \quad (12)$$

where *Occ* is the average daily occupancy rate and *ADR* is the Average Daily Rate. In order to make the final adjustment to the above-mentioned extreme values, it is advisable to know the exact distribution function of the variable (in this case *RevPAR*). In order to correctly estimate the progress of this distribution function, an extension to MS Excel software was used, specifically CrystalBall from Oracle. In this software was used a feature allowing estimate the best distribution of a random variable. Normal distribution was always recommended for all years. For purging high and low values, there were selected only such *RevPAR* values that are greater than 10% percentile and lower than 90% percentile. The adjustments described above are made for each year, and consequently, only data that reaches *RevPAR* values between the mentioned percentiles is processed. These values better reflect the real market situation and are more appropriate for achieving the objective of the paper.

2. Results of the Research

After carrying out the regression analyses in order to determine the price elasticity of demand in individual years and cities, empirical regression functions were determined, which are shown in the following table 1. At this point, it is also necessary to mention that the determination coefficients for all monitored periods and cities show values above 0.79 and it can be assumed that the approach is appropriate.

Tab. 1: Regression functions

Year	Prague; regression functions
2014	$\log Q = 5,04395 - 0,34200 \log P + e$
2015	$\log Q = 4,82633 - 0,19568 \log P + e$
2016	$\log Q = 4,66910 - 0,10905 \log P + e$
2017	$\log Q = 4,57788 - 0,05039 \log P + e$
2018	$\log Q = 4,53250 - 0,03360 \log P + e$
	Berlin; regression functions
2014	$\log Q = 5,24969 - 0,27944 \log P + e$
2015	$\log Q = 5,11404 - 0,19679 \log P + e$
2016	$\log Q = 4,62334 - 0,06063 \log P + e$
2017	$\log Q = 4,46714 - 0,14126 \log P + e$
2018	$\log Q = 4,26241 - 0,25793 \log P + e$

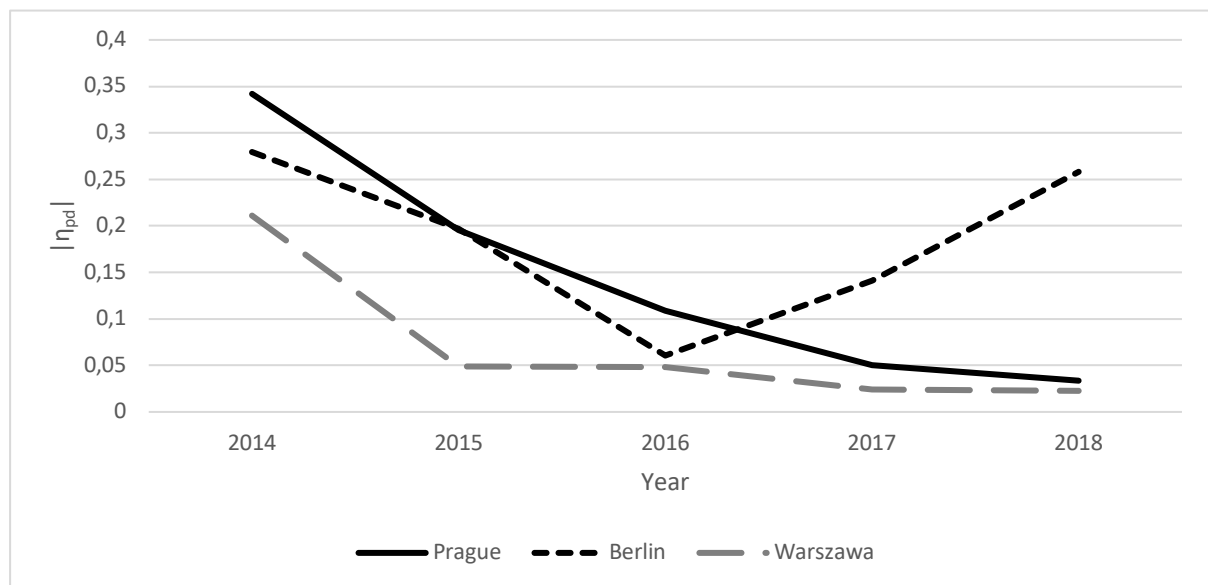
Year	Warszawa; regression functions
2014	$\log Q = 4,37432 - 0,21106 \log P + e$
2015	$\log Q = 4,13072 - 0,04892 \log P + e$
2016	$\log Q = 4,14752 - 0,04850 \log P + e$
2017	$\log Q = 3,63191 - 0,02403 \log P + e$
2018	$\log Q = 4,12626 - 0,02267 \log P + e$

Source: authors' calculations

The above-mentioned regression functions could be summarized in a single graphical expression, so that we can better understand the evolution of the price elasticity coefficient η_{pd} (i.e. the estimate of parameter β_1) and also make a comparison in all monitored cities. The results of measured elasticity are presented in absolute values. Such output is presented in the following figure 1.

The values as mentioned above show the calculated price elasticity of demand for individual markets of accommodation services. First of all, it is necessary to mention that in all monitored years and cities, the market of accommodation services always shows inelastic demand about the market price, since the price elasticity coefficient η_{pd} is lower than one (measured in absolute values). The percentage change in the quantity demanded is lower than the possible percentage change in price. It is also advisable to point out the relatively similar evolution of price elasticity in all cities between 2014 and 2016 when price elasticity generally continued to decline and showed lower consumer sensitivity to change in price.

Fig. 1: Price Elasticity of Demand from 2014 to 2018



Source: authors' calculations

Interestingly, we have been observing the growth in the price elasticity of demand only in Berlin and still decreasing trend in Prague and Warsaw since 2016. This different evolution may be due to several factors. One of these factors may be different economic development of the countries whose tourists use given collective accommodation facilities (where the relationship between domestic and foreign tourists using the collective accommodation facilities in Berlin would be more sensitive to change in price due to the deterioration of the economic situation – or the deterioration of future development). Another factor that can divide these three destinations in terms of the different evolution of price elasticity of demand since 2016 is the effect of shared housing, which has been strongly regulated in Berlin over the years, as it has experienced a significant increase. However, the measurements can serve primarily as methodological inputs for further studies or as empirical data for comparison with other destinations.

3. Discussion

As stated by Tran (2015) or Hiemstra et al. (1993), the market for accommodation services seems to be generally price-inelastic. The values of price elasticity are low in the long term and are often close to zero. This fact shows that the decrease of the price (on the market as such) will not lead to an increase in total sales. The results of this research confirm the fact that Rest and Harris (2008) assumed in their research, demonstrating that the decrease of the price does not lead to an increase in overall sales of accommodation facilities. Their assumption was the fact of low price elasticity proven in this paper. Based on the research, the following strengths and weaknesses of the methodology described above were also found out. It is necessary to consider the versatility of the given method as a strength, which can be applied to the whole market as well as to sub-entities in the market. However, it is necessary to use the appropriate data and simultaneously it is necessary to have a sufficient amount of this data, which can be considered a weakness of the given method. At the same time, it should be noted that the regression function was used, which is linear in the parameters and therefore cannot be applied to demands (or supplies) that do not show a linear relation. In this paper, however, there were relatively high determination coefficients that show the selected regression function is appropriate for solving the issues.

Conclusion

The primary findings presented above can be summarized in two basic conclusions. The first one is that the price elasticity of demand in the market of accommodation services shows a level lower than 1 (measured in absolute value) in all monitored destinations (Berlin, Warsaw and Prague), thus demonstrating the price inelasticity of demand. The second finding is related to the comparison of individual destinations, which shows that in Prague and Warsaw, the monitored markets show very similar evolution in the form of long-term decreasing price elasticity of demand. The situation in Berlin is different, with a gradual increase since 2016. However, price elasticity values are still below level 1 and show price inelastic demand. Possible future development of analyzed situation allows two possible scenarios. One of them is the gradual expansion of the imaginary scissors (measured by the price elasticity of demand) between Berlin and other analyzed cities when the price elasticity of demand would increase. The second scenario would mean

reducing this gap. In the case of the first mentioned situation, the price elasticity values (given by the increasing rate of the η_{pd} in Berlin) could approach 0.4. It would be desirable to characterize further the cause of such a development, which is suitable for more profound scientific research.

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Best Way to Assess Resilience? Theoretical and Methodological Clarification of Resilience

Abstract

The paper deals with the resilience of regional economies, which represent the current direction of the European Union. Economies have always been prone to different kinds of shocks, such as economic downturns, industry shocks, currency crises, which can destabilise the path and pattern of regional economic growth. Regional economy perturbed by a shock may move onto a new growth path by re-establishing economic linkages both internally and with other regions. The question of why one region is more vulnerable to economic shock than others and what are its competitive advantages and disadvantages, impelled to analyse resilience notion in a regional development context. The paper concentrates on regional analysis, specifically on the definition of factors of the resilience of regions. Several methods of evaluating regional economies exist, most of the methods have their limitations, especially in the selection of relevant indicators and weighting scheme. Despite the limitations, several approaches have been proposed by the EU and the other institutions, especially in the form of composite or synthetic aggregate indicators or indices. The paper aims to throw light on some of the underlying aspects of regional resilience and give an overview of the notion in line with planning tasks concerning regional resilience. Based on the systematic literature review, the related objective is to introduce the method of construction of the index from a methodological point of view.

Key Words

Composite index, factor, method, regional economy, resilience, shock

JEL Classification: B41, O18, P51, R11, R58

Introduction

The territory has only recently become a terrain of strenuous economic research. With the New Economic Geography integrating into the mainstream, many spatial subjects, including territorial, or regional, competitiveness are being increasingly inquired. In line with Krugman (2003), it is plausible to discuss competitiveness on a regional level, as a capacity of territories to attract and retain mobile factors of production, which is an increasingly important subject in an ever integrating global economy. However, this branch of economic geography is relatively underdeveloped, while it even lacks a universally accepted definition and metrics. Over the last decades, regional competitiveness has been deeply investigated and these studies reveal how all the regions are not equally able to face the challenges that the new competition – affected by changes in the international environment – proposes but they fail in supplying both an exhaustive explanation and a pertinent, accessible and transferable measure of it. Therefore, competitiveness has been a crucial issue on the European Union's (EU) agenda for several decades too. Understood more comprehensively – as including both productivity and

prosperity – it can be seen as a way to create favourable business conditions for companies and to increase the standards of living of the population. Supporting competitiveness, especially in the case of nations and regions, requires creating framework conditions to develop the necessary infrastructure, human capital, technology and efficient markets that can help attract talent and investment. Being competitive also means having sufficient prerequisites for being able to withstand unexpected external shocks, i.e. the ability of a regional economy to resist, absorb or overcome an internal or external economic shock. It is worth noting that resilience to an economic shock does not necessarily imply that the economy is otherwise strong and performing well over the longer term. Resilience has been a topic of growing interest as economic development practitioners have sought to understand the factors that affect the ability of an area to withstand and respond to economic shocks. While there are clear signs of economic recovery, evidence suggests that recent growth has been unbalanced. This, combined with the well-documented impact of the economic crisis, highlights the importance of ensuring that local economies continue to address structural issues and increase their resilience. Globalisation, rapid technological change, deep recessions, and human-made disasters have generated interest in regional economic resilience as an essential field of study. The economic impact of these exogenous shocks and recovery mechanisms differs from region to region. Lack of economic diversification is one of the major weaknesses that limit the ability of a region to absorb an external shock, as stated by Staníčková and Melecký (2018).

The paper aims to throw light on some of the underlying aspects of regional resilience and give an overview of the notion in line with planning tasks concerning regional resilience. Based on this literature review, the related objective is to introduce the method of construction of the index from a methodological point of view. Empirically, the primary purpose of the measures of the resilience of European regions at the NUTS2 level is developing a composite index approach, i.e. the Regional Resilience Index (RRI). Why measuring regional resilience is so important? Because if you cannot measure it, you cannot improve it (Lord Kelvin). A quantitative score of resilience will facilitate the EU Member States in identifying possible regional weaknesses together with factors mainly driving these weaknesses. Therefore, the final numeric score will assist regions in catching up the process. In doing so, the paper looks at the impact of a variety of factors within resilience, taking into account regional differences, which will affect their relative importance. In this case, RRI can be used to help regions assess which aspects of resilience are the strongest and which ones need improvement. RRI could make it easy for a region to compare itself to all other regions, to spot regions with a similar level of resilience, and to identify regions it could learn from. Regional development strategies could use RRI to identify possible regional development priorities.

1. Understanding of Resilience

In a relatively short period, scientific progress has made available access to the global level of understanding the whole economic sphere. As a result, researchers consider the question of economic resilience in the global perspective. Each school allocated its economic approach and framework for the study of the resilience, which corresponded to historical conditions of evolutionary development. Throughout the evolution of economic theory, the scientific community has not been able to give an exhaustive answer to the

question: what measures can lead to the well-being of a society? Following each crisis, new theories were developed, hoping to find a solid foundation for sustainable growth, as well as identifying new tools of regulation of the economic field, and so on until the next crisis. Economies (i.e. the different type of territories) have always been prone to significant perturbations and shocks: recessions, significant policy changes, currency crises, technological breakthroughs, and the like, can all disrupt and destabilise the path and pattern of economic growth. It is within regional, urban and local economies and communities that such shocks and disturbances work out their effects and consequences. Nationally, or globally, originating shocks are rarely spatially neutral or equitable in their impact or implications. In addition to national or global disturbances, locally originating and locally specific disruptions are also far from infrequent. It would seem logical enough to assume that the notion of resilience is highly pertinent for analysing how regions react to and recover from shocks, and thence for understanding the role such shocks might play in shaping the spatial dynamics of economic growth and development over time (Martin and Sunley, 2015).

Resilience is more than being ready for long-term threats. It indicates that a system can recover to some workable point despite changes and hardships. Resilience suggests that economic prosperity is more likely in diversified economies. From a local development perspective, economic development can be pathological if the economic change erodes the community base or increases the vulnerability to macroeconomic fluctuations. Development programs must be designed to harbour the core community values while offering new economic opportunities. Attention to resilience in economic development planning can preserve the region's economic and social integrity because it generates sustainable development that is resistant to social degradation as well as insulated from macroeconomic fluctuations. Briguglio et al. (2009) argue that policies contributing toward more excellent macroeconomic stability, microeconomic market efficiency, good governance and social protection underpin economic resilience. As it is often the case with new ideas (such as competitiveness which is an attribute of a strong economy and contains a variety of values and intersects with values like resilience), the notion of regional and local economic resilience is already finding currency among those interested in policy. Resilience is emerging as an imperative whose time has come in policy debates around regions, propelling a new discourse of constructing or building regional economic resilience.

Two questions – ‘Resilience of what?’ and ‘Resilience to what?’ – Have been used to define resilience. Do these questions clarify the system or regional focus, is it about a community, a spatial area or a place at a point of activities in time? In regional studies, resilience is a growing, multi-dimensional concept, and has been conceptualised in various ways to explain differences between economies of regional type (Hill et al., 2012; Bristow and Healy, 2014; Martin and Sunley, 2015). Detailed descriptions and definitions of the resilience concept used in different disciplines are given by Rose (2009). Despite the many definitions, it appears that there is some consensus among researchers and practitioners on common attributes of resilience. Regional resilience is defined as the ability of a region to anticipate, prepare for, respond to and recover from a disturbance (Foster, 2006) and describes it as the ability of a community to absorb, deflect or resist disaster impacts, bounce back after being impacted, and learn from experience and modify its behaviour and structure to adapt to future threats. Most of the studies refer to resilience as the ability of any system to recover from an external shock or to absorb

against downturns (Rose, 2009; Briguglio et al., 2009). Based on Martin (2012), regional resilience is a multi-dimensional property involving four interrelated dimensions describing response to shock: resistance, recovery, re-orientation and renewal. It has been variously applied to mean resistance to change (Hill et al., 2012; Martin, 2012; Bristow and Healy, 2014), preparedness for change or mitigation (Bruneau et al., 2003; Martin, 2012; Bristow and Healy, 2014), or ability to absorb shocks (Bristow and Healy, 2014), recover (Bruneau et al., 2003), or adapt (Bristow and Healy, 2014; Martin and Sunley, 2015). The term implies both the ability to adjust to normal or anticipated levels of stress and to adapt to sudden shocks and extraordinary demands. For regional economic analysis, perhaps the most natural conceptual meaning of resilience is the ability of the regional economy to maintain or return to a pre-existing state (typically assumed to be an equilibrium state) in the presence of some exogenous shock. Regional resilience to economic shocks can vary over time not only because of differences in the causes and nature of individual recessionary shocks but because the features that shape resilience may themselves evolve and change.

2. Factors of Resilience

What helps build or shape resilience? The structural factors developing resilience might usefully be labelled as the 'inherent' components of resilience in social systems, i.e. the factors which shape innate capacities to react, or the autonomous responses to shocks (Rose, 2009). In economics, for example, such mechanisms might include automatic fiscal stabilisers and the ability of markets to reallocate resources or substitute inputs in response to price signals. Building on complex adaptive systems thinking, these internal components relate to the system's capacities to self-organise (Staníčková and Melecký, 2018). The emerging empirical evidence suggests that one set of internal factors shaping regional resilience to economic shocks is their initial strengths and weaknesses (Huggins et al., 2010). This seems to affirm the theoretical assertions of evolutionary economic geography that regional resilience is likely to be path-dependent and shaped by a region's industrial legacy, the nature of its pre-existing economy (principally what is happening to the product and profit cycles of its key, particularly export, industries), and the scope for re-orientating skills, resources and technologies inherited from that legacy (Boschma and Martin, 2010; Simmie and Martin, 2010). In a study of the impact of the post-2008 financial crisis and recession on several European regions, Huggins et al. (2010) have found that factors such as the size of the market, access to a broader external market, as well as endowments in natural resources and physical and human capital play an important role in shaping variable impacts. Another critical structural or inherent dimension appears to be the sectoral structure of regions. In general terms, a region's vulnerability to adverse economic shocks is correlated with its sectoral specialisation, although the degree of regional specialisation has decreased in Europe since the 1950s not least due to the growth of public services and some private services in all regions (Huggins et al., 2010). Again this appears to support theorising drawing on the evolutionary conception of resilience which has highlighted the merits of 'species diversity' for regional economies. Diversity is deemed essential in complex adaptive systems both in terms of absorbing disturbance and in regenerating and re-organising the system following the disturbance. Studies suggest that regions which specialise in a narrow range of sectors are particularly vulnerable to sectoral shocks and run the risk of suffering permanent reductions in the numbers of firms and jobs (Huggins et al., 2010) –

or negative hysteretic effects (Martin, 2012). A more diverse economic structure provides higher regional resistance to shocks than a more specialised structure since risk is effectively spread across a region's business portfolio, although a high degree of sectoral interrelatedness may limit this (Martin, 2012), as stated in report on Economic Crisis: Resilience of Regions (ESPON, 2014).

Nowadays, regions all over the world are facing pressures that are forcing them to rethink the impacts of policies aimed at competitiveness and integration into the global economy on their socio-spatial structures, following a period of entrepreneurial strategies shaped by the notions of globalisation and competition (Eraydin and Tasan-Kok, 2013). However, the existing assets of competitiveness can quickly be eroded, since their effects may differ from place to place. More importantly, the reliance on global conditions and the dominance of deregulatory measures make regions vulnerable in economic terms. In these cases, a system can fail, leading to a significant reduction or complete loss in performance concerning some or all measures. Resources are then needed to restore a system's performance to its normal levels. Similarly, the performance of a system over time can be characterised as a path through the multidimensional space of performance measures. This characterisation of system performance leads to a broader conceptualisation of resilience and to the question: what are the main characteristics of regional resilience? The first group of factors suggests Martin (2012) and among the critical elements of regional resilience ranks: dynamic growth of the region, the structure of the economy, export orientation and specialization of the region, human capital, innovation rate, business and corporate culture, localization of region, and institutional arrangement in the region. The second group of factors defines Foster (2006) and among the critical elements of regional resilience suggests regional economic capacity, the socio-demographic capacity of the region and regional community capacity. To capture the effects of shock absorption or shock counteraction policies across countries, Briguglio et al. (2009) proposed four components (and their related indicators) of a resilience index, i.e. macroeconomic stability, microeconomic market efficiency, good governance and social development. Koutský et al. (2012) engage issues of regional resilience determinants and define the following factors: the main macroeconomic indicators, labour market indicators and additional ones. Based on these three sets of factors of regional resilience above, Melecký and Staníčková (2015) have defined a set of indicators of regional resilience (also remarkable in terms of competitiveness), and this approach was used for purposes of construction of a composite weighted index of regional resilience. In their study, five dominating factors (including indicators) of regional resilience has been extracted: community links, human capital and socio-demographic structure, labour market, economic performance, innovation, science and research.

3. Measuring of Resilience

Not only the definition but also a way of evaluation is the challenging issue of research of resilience. The concept of resilience is rather complicated and deep in content as well as quite complex for assessment and measurement. Nowadays, there is no universally agreed notion of resilience in the context of regional development as well as considerable ambiguity about what, precisely, is meant by the idea of regional economic resilience, about how it should be conceptualised. There is still no one generally accepted methodology for how regional resilience should be measured, what its determinants are,

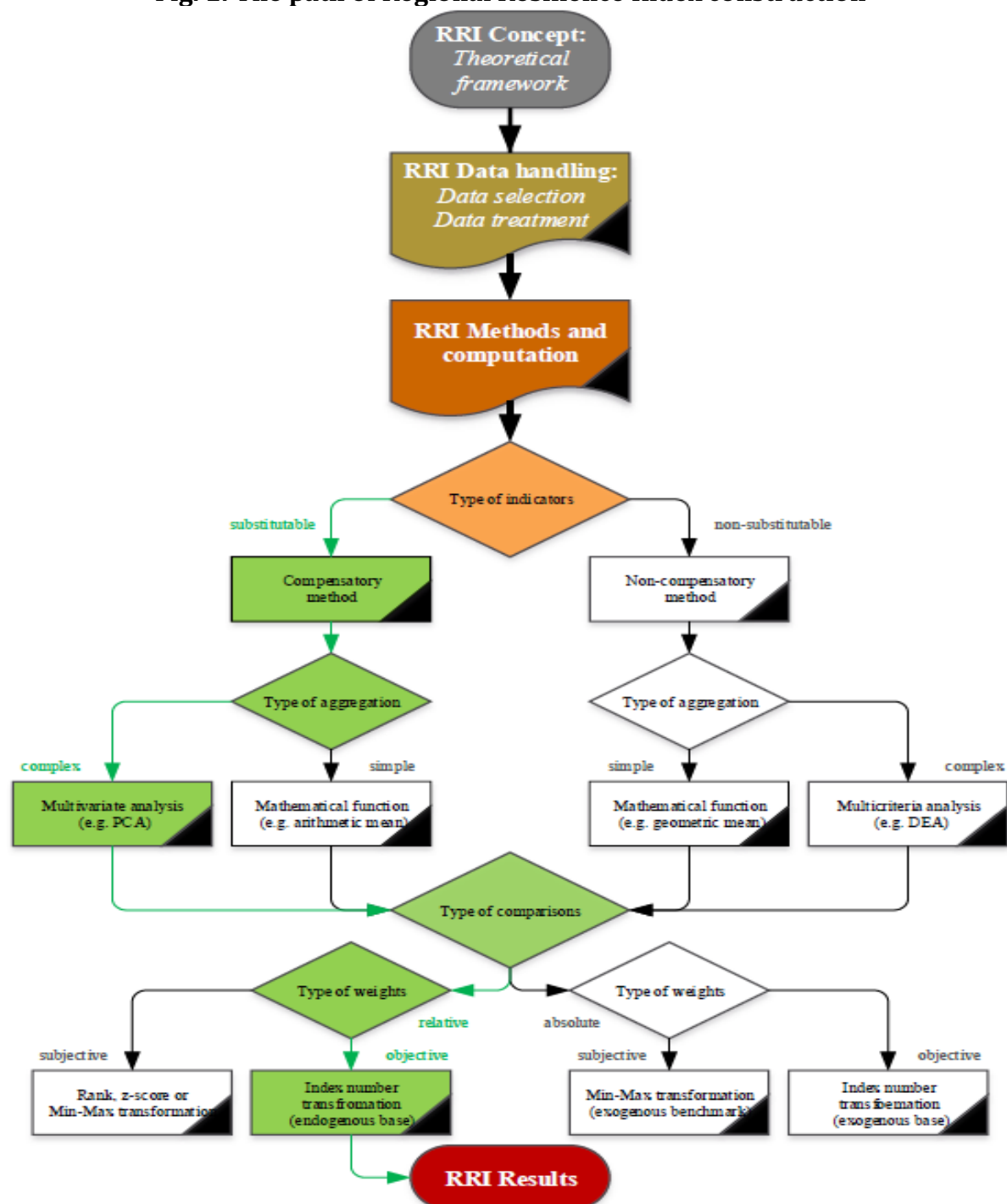
and how it links to patterns of long-run regional growth. Consequently, it leads to an absolute misunderstanding and different variations in using of resilience concept and approaches of its measurement. Lack of specificity in the use of the term resilience has ensured it is difficult to operationalise, thus continuing to confound the term through the misalignment between the concept and its measurement. Opinions vary to the definition of resilience, and there is no mainstream approach to analysis and expression of resilience and thus, no uniform strategies for strengthening the resilience of economies.

Quantifying systems and regional resilience is a complex process, and scales for measuring resilience, at any level, do not currently exist. In the last years, the debate on the measurement of multidimensional phenomena has renewed interest. Analysis the progress that societies have made in their developmental efforts has proven to be challenging but also very popular. It is a common awareness that several socio-economic phenomena cannot be measured by a single descriptive indicator and that, instead, they should be represented with multiple dimensions. Aspects such as development, progress, poverty, social inequality, well-being, quality of life, provision of infrastructures, etc., require, to be measured, the 'combination' of different dimensions, to be considered together as the proxy of the phenomenon. This combination can be obtained by applying methodologies known as composite indicators or indices (CIs). CI is the mathematical combination of individual indicators that represent different dimensions of a concept whose description is the objective of the analysis (Saisana and Tarantola, 2002), as well as see Staníčková (2017) or Melecký (2017).

As is known CI building is a delicate task and full of pitfalls: from the obstacles regarding the availability of data and the choice of individual indicators to their treatment to compare (normalisation) and aggregate them (weighting and aggregation). Despite the problems mentioned, the composite indices are widely used by several international organisations for measuring economic, environmental and social phenomena and, therefore, they provide an extremely important tool and in the course of evolution (OECD, 2008).

CI construction involves stages where subjective judgement has to be made: the selection of indicators, the treatment of missing values, the choice of aggregation model, the weights of the indicators, etc. Therefore, the main factors to take into account in the decision of the method to be adopted for summarizing individual indicators are as follows (Mazziotta and Pareto, 2013): type of indicators (substitutable/non-substitutable), type of aggregation (simple/complex), and type of comparisons (absolute/relative), type of weights (objective/subjective). If the phenomenon to be measured is decomposable into more dimensions, each of them is represented by a subset of individual indicators; it may be more convenient to build a composite index for each aspect (or 'pillar') and then obtain the overall index using the aggregation of the partial composite indices. In this case, it is possible to adopt a compensatory approach within each dimension and a non-compensatory or partially compensatory approach among the various dimensions.

Fig. 1: The path of Regional Resilience Index construction



Source: authors' suggestion and elaboration (Staničková, 2018)

The most used aggregation methods for substitutable indicators are the additive ones, such as simple arithmetic mean or PCA. For non-substitutable indicators, non-linear methods are instead used, such as multiplicative functions (partially compensatory approach) or Multicriteria Analysis (MCA, non-compensatory approach). Focusing on methods based on the use of mathematical functions, the type of normalisation depends on the nature of the space-time comparisons to do and on the weight to be assigned to the individual indicators. For relative comparisons with subjective weighting (equal or different weights), it is recommended to use the rank, z-score or min-max transformation.

For assigning objective weights proportional to the variability of the indicators is more suitable an index number transformation where it is assumed as a base the mean, the maximum value or another reference value of the distribution (endogenous base). For absolute comparisons, it is not possible to use ranking or standardisation. In the case of subjective weighting, it is necessary to resort to a min-max transformation with minimum and maximum values independent of the distribution (exogenous benchmark), whereas, in the case of objective weighting, an indication with the externally fixed base may be a good solution (exogenous base), for more information see Staníčková (2018). In Figure 1 is shown the 'path' followed in the design of RRI.

Conclusion

Economies have always been prone to different kinds of shocks such as economic downturns, industry shocks, currency crises, which can destabilise the path and pattern of regional economic growth. Regional economy perturbed by a shock may move onto a new growth path by re-establishing economic linkages both internally and with other regions. The question of why one region is more vulnerable to economic shock than others, compelled to analyse resilience notion in a regional development context and identify their strengths and weaknesses in terms of resilience and flexibility. The idea of resilience has recently risen to prominence in several disciplines and has also entered policy discourse. The 21st century sees changes in modern society, social structure, territorial policy, public administration and other fields, generated by the EU, which have a significant impact on the functioning and efficiency of the whole society. For real competences to find their appropriate places and levels, a mature society is required as well as the investigation and improvement of the maturity of regional levels before implementing any measures. The practice of spatial planning pointed to the need to create a CI with which you can get a broader perspective on the territory. The quality of CI, as well as the soundness of the messages it conveys, depend not only on the methodology used in its construction but primarily on the quality of the framework and the data used. A composite based on a weak theoretical background or soft data containing significant measurement errors can lead to disputable policy messages, in spite of the use of the state-of-the-art methodology in its construction.

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Section IV

Entrepreneurship and Industry 4.0

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Optimization of clickable elements on the websites based on user behaviour

Abstract

Understanding user behaviour and interaction with the elements on the website is crucial for maximising conversions and designing the layout of any website. The present study is based on series of experiments on the websites. The aim of the study is to find out factors influencing click-through rate of the selected elements and to analyse scrolling behaviour of the users. Various button text styles were tested and analysed from click-through rate point of view. The present study explores factors which influence click-through rate and performance of these website elements. The first series of the experiments on 4 pages at the websites of the university VŠE were conducted. Various text links and text in buttons were tested. In experiments we tested click-through rate of the text links and text in buttons through the heatmaps software and by measuring the hits on the buttons. There were tested various forms of the text – verb in the polite form of address, verb in the informal form of address, the call to action in form of the noun instead of the verb. The second series of the experiments consisted of analysing the length of the various websites with the different length. Results of the study show how the text of the buttons influence click-through rate of these buttons, how users of the websites behave on the websites and how users interact with the elements on the websites.

Key Words

human computer interaction, user interface, clickable elements, website components, web usability

JEL Classification: M31

Introduction

Thousands of web usability guidelines were written, but remarkable 80 % of findings and insights from the web usability studies in the 1990s continue to hold and they are still valid (Nielsen, 2007). One of the most important website-component is clickable element which stands for desired action on the website. The present study explores factors which influence click-through rate of the elements on the websites and scrolling behaviour of the users. The first series of the experiments were conducted on 3 pages at the websites of the Faculty of Business Administration. Various text links and texts in buttons were tested whether they influence click-through rate. The click-through rate of the diversified forms of the text were measured – verb in the polite form of address, verb in the informal form of address, the call to action in form of the noun instead of the verb. The second series of the experiments consisted of analysing the length of the various website and user scrolling behaviour on the websites with the different length. The following hypothesis were set: H1: Clickthrough rate of buttons on the website is independent on the text of the

buttons. H2: Clickthrough rates of highlighted buttons are equal to click-through rates of paragraph headings. H3: There is different scrolling behaviour between desktop version and mobile version. H4: There is different scrolling behaviour of people on the web page when website element is added and prolong the webpage. H5: There is lower click-through rate with lower placement of the elements on the webpage.

1. Literature review

One of the first research of computer interaction and software usability is the study from John Gould and Clayton Lewis which is investigating the importance of the end-user presence during the development of the software and applications (Gould, 1985). Fred Davis in his study came with the method which could uncover the most important factors influencing usability satisfaction and user experience with information technology (Davis, 1986). Jakob Nielsen, leading expert in user experience and usability testing, published in 1990 his study where he investigated ideal number of testers in accordance with the uncovered problems and costs of testing (Nielsen, 1990). Steve Krug made the importance of the usability testing more visible by his book „Don't Make Me Think“, where he described how managers, developers and owners of the websites should approach to the website projects (Krug, 2000). Usability testing of the websites and applications becomes important part during the development process, but also after launching even small changes on existing websites. In 2003 book *Observing the User Experience* was published, where the author Mike Kuniavsky looked into the right usability testing procedure. This book is often said the best manual for usability testing (Kuniavsky, 2003). Tullis and Albert published book *Measuring the User Experience* in 2008 where they summed up step by step procedure how to do usability testing, which method to use and when, how to do right gathering of the data and how to quantify and evaluate the usability testing findings (Albert, 2013). Sauro and Lewis came up with the book *Quantifying the user Experience* in which they work with the usability testing findings like with the inputs to advanced statistical methods (Sauro, 2016).

1.1 Reading on the website

People rarely read long text on the websites. Instead of reading word by word, they scan the page. In Nielsen's research it was found by eye-tracking that 79 % of the test users always scanned new page they came across. Only 16 % read word-by-word. As a result, web pages have to contain scannable and well-structured text - highlighted keywords, meaningful headings and subheadings, bulleted lists etc. (Nielsen, 1997). Harald Weinrich in his study from 2008 tested time spent on the websites. Various pages had between 30 and 1250 words (Weinreich, 2008). Jakob Nielsen used this dataset and got interesting findings after cleaning this dataset and analysing. Users tend to spend more time on pages with more information. Nevertheless, research shows us that user spend 4.4 seconds more for each additional 100 words. At the reading speed 250 words per minute it means that users read approximately 18 words in 4.4 seconds. So, when you add verbiage to a page, it is expected that customers will read 18 % of it. Nielsen also measured the maximum number of words users would be hypothetically able to read. On an average visit of the webpage, users can read half the information on those pages with 111 words or less. The average page view in the full dataset contained 593 words. According to

analysis users read only 28 % of the words if they spend all of their time to reading. It means in reality that users will read approximately 20 % of the text on the average page (Nielsen, 2008).

1.2 Scrolling and Attention

Since the mid-1990s, when the internet became broadly accessible to the public, users rarely scrolled vertically on the websites. Up to 1997, as long pages became common, people learned to scroll. However, the part of the website above the fold still catch peoples' attention the most. According to a broad eye-tracking study of user behaviour, which was done by Jakob Nielsen in 2010, 80.3 % of the user viewing time was above the fold of the webpage. 19.7 % of the user viewing time was below the fold of the webpage (Fessenden, 2018).

The fixation of the user's attention depends also on the style of the website and the purpose of the particular webpage. Webpage with FAQs will have different viewing pattern in comparison with homepages or product catalogue webpage. People look down a page if the webpage layout encourages scanning or the initially viewable information makes users believe that it will be worth their time to scroll. Nevertheless, overall result from conducted studies is that the most important information and call to action buttons and links (users' goals or business goals) should be placed above the fold (Nielsen, 2010).

The result of studies also confirms reading pattern which is called F-pattern. Characteristic of F-pattern is when users tend to look more thoroughly at the elements and text placed close to the top of the page from left to the right side (Arabic countries from right to the left) and then spend fewer and fewer fixations and time on information, elements and text that appears low on the page. To sum it up designers and managers must be aware of the fact that while modern webpages tend to be long (e.g. one-page website) and users may be more inclined to scroll than in the past, people still spend most of their attention and viewing time in the top part of a page (Fessenden, 2018).

1.3 Three-dimensional Design vs. Flat Design and minimalism

Three-dimensional effects give users an illusion of depth, which help see visual hierarchy and better see and understand which elements are static and which are interactive. In general people got used to the following visual design: 1. Elements which appear raised look like they could be pressed down. This type of buttons is visible also in public transportation etc. 2. Elements that appear sunken or hollow look like they could be filled. This type of elements is often used as a signifier for input fields (e.g. textbox, search field, reply box etc.).

Flat design is nowadays often used and popular style which is defined by the absence of three-dimensional website elements and 3D visual effects. Flat design is considered as a reaction to skeuomorphism design which can be defined as an object that has unnecessary, ornamental design features that mimic a real-world precedent and intend to help users understand how to use a new interface by allowing them to apply some prior experience and knowledge about that precedent (Moran 2015).

With flat design are unfortunately connected also some usability issues (bad visibility of clickable elements etc.) and sometimes flat-designed websites tend to sacrifice users' needs for the sake of trendy aesthetics. Nowadays users are better at detecting linked elements than before, but even though in long-term exposure to flat clickable elements has been noticeable user efficiency reduction by complicating users' understanding of what is clickable and what is not. And the recognition of clickable elements with important call-to-action is for business and for successful meeting of the goal absolutely crucial (Moran, 2017).

Usability issues within flat design were proved for example in the experiment which was done in 2017 by Kate Moran. There was conducted a quantitative experiment using eye-tracking equipment and desktop computer. 9 web pages were taken and modified. Nearly two identical versions of each page, with the same layout, content and visual style were created. These two versions differed only in the use of strong, weak, or absent signifiers for interactive elements (buttons, links, tabs, sliders etc.). 71 general web-users were recruited and to each participant was shown one version of the 9 sites and one task for that page was given. Eye movements of the participants were tracked and the number of fixations, as well as the task time, were measured. The average amount of time and the average number of fixations were significantly higher on the weak-signifier versions than the strong-signifier versions. On average participants spent 22 % more time looking at the pages with weak signifiers and had 25 % more fixations on the pages with weak signifiers. More time and effort spent looking around the page are not good. The weak-signifier across the page also caused that people had to look around more and it changed also user gaze patterns (Moran, 2017).

The other study tested the impacts of two clickability cues (depth and colour contrast of the buttons) on a users' ability to find and click on the button. 20 participants were asked to find and click on call-to-action button on various websites while their gaze was tracked with an eye tracker. A post-hoc pairwise comparison showed that participants fixated on the button significantly faster when contrast was present than when contrast was absent and post-hoc independent samples t-test revealed that when contrast was absent, participants fixated on the AOI faster when depth was present than when depth was absent (Lucaites, 2017).

It is advised to have a balanced approach and if designers or managers want to design flat design look, it is necessary to keep in mind what is important for users than what is managers' or designers' taste and desire.

1.4 Clickable Elements

Clickable elements must retain sufficient cues to suggest clickability. Signalling clickability with cues such as text, colour, size, shape, borders and placement can give interactive components the proper look. As Nielsen Norman Group says: "People treat clicks like currency and they don't spend it frivolously" and "life is too short to click on things you don't understand" (Loranger, 2015).

One of the most important factors in attracting clicks is the link text quality. The link text should be unique, descriptive, start with keywords and contain call-to-action text. The

most helpful link text describes the page that's being linked to and start with the most important words. High-quality text links help users improve page scannability and thus the orientation on the page is much easier for the users. According to the eye-tracking research done by Jakob Nielsen in 2009, first 2 words and their meaning is the main signal for the scanning eye (Nielsen, 2009). By typical clickability elements are meant text links, buttons, symbols or icons, images or graphics.

The most traditional cue for hyperlinks is text link. The blue colour is the safest link colour, meanwhile other colours work just as well as long as the links are visible in the body text. If there is no particular reason to prefer another colour, it is still recommended to have blue text links as the safest choice. The position of text links can help you determine whether or not underlining is necessary. The navigation menu and lists do not require underlining, because already their locations and purpose identify them as links. The designers and managers must be aware of the fact that the static items should not have the same colour as hyperlinks, and it is not recommended to use blue text or underlined text for non-clickable items and text links should be consistent throughout the whole website (Loranger, 2015).

Buttons, symbols and icons are the most popular forms of link text nowadays. These elements should at least remotely resemble physical items from real world. In order to be recognizable, these clickable elements must keep the right visual design to trigger the right, quick and accurate association. Interactive components in flat design should look clickable even without effects such as gradients and shadows. Non-clickable items should not look like the buttons and confuse peoples' mind. If there are too many clickable elements people could have difficulty picking out the right one (especially, when similar-looking items compete each other). If there is not a really strong resemblance shape or an icon that has become standardly used, it is recommended to be always combined with other visual sign, such as a text label. Sometimes icons added to buttons or other clickable visual items, especially in flat design, help people to indicate clickability (Loranger, 2015).

Using images and graphics as clickable elements can be confusing (especially, when they are not part of some whole component (e.g. tile)). It is highly recommended to make all elements that are associated with each other clickable. There is bigger probability of capturing intended clicks by this way (Loranger, 2015). In order to capture more clicks and to make clear that image or graphics is clickable, it is good to use mouseover effect and effect when image or graphics is clicked (e.g. change colour or zoom in an image or graphics after mouseover or enlarge image when clicked).

2. Methods of Research

In this study experiments on three webpages on the websites of Faculty of Business Administration were conducted (<https://fph.vse.cz/uchazeci/bakalarske-studium/>, <https://fph.vse.cz>, <http://myfph.cz/uchazec/>). The experiments consisted of two parts. First part researched the optimal type of text link from the click through rate point of view. In experiments we tested click-through rate of the text links and text in buttons. There were used heatmaps analysis and scroll-maps analysis in this study. Hotjar heatmaps, which were scanning the behaviour of the users, were set on 3 webpages.

Analysing of the hits through the buttons on google tag manager and google analytics was set on the webpages.

Three types of the text were tested (verb in the polite form of address, verb in the informal form of address, the call to action in form of the noun instead of the verb). We also studied relation between clickable links in form of highlighted buttons and plain headings.

The second part of the research investigated the length of the webpages and how people scrolled on the webpages. The results of this second part of the research showed where the most important information should be placed and how much people scroll on the webpages, how far users scroll, if there is point in having a long webpage. Finally, we studied relation between clickable elements of webpages and scrolling behaviour of people.

Respondents in our experiments were all the visitors of the websites <https://fph.vse.cz/uchazeci/bakalarske-studium/>, <https://fph.vse.cz> and of the website <http://myfph.cz/uchazec/> (visitors who immediately left the websites without doing any action were excluded). Respondents were between 18 and 34 years old in most cases (80 % of the respondents). Respondents were from Czech Republic in most cases (90 % of the respondents). Gathered data were analysed using statistical methods. As most of the data at our disposal are categorical, and in a lot of analysis our aim was to find dependence/independence of certain web page elements on their change, given differently by each experiment. Main statistical tool we used was Pearson chi-square statistics (Hebák, 2015) to test our hypothesis. Statistical analyses were performed using statistical programming language R - R core team (R Core Team, 2018) and results were interpreted using 5% level of significance.

2.1 Base characteristics

Important part of our experiments deals with the perception of web page by its users. Modern web pages use fluid structures that allows them to adapt for different screen size and its resolution. This causes substantial changes in appearance and design of the web page according to used device. Because of that, it's common to distinguish 3 basic types of devices that are being used for viewing web pages – phones, tablets and desktops.

In our experiments we use data about behaviour of users from phones and desktop. Tab. 1 shows basic long-term characteristics about visitors of website <https://fph.vse.cz/>. Low representation of visitors from devices in tablet group led us to exclusion of that group from our experiments. Decision to leave out tablets from our experiments is also based on the structure of the web page <https://fph.vse.cz/> which has two structures of appearance that are focused either on the mobile (long version) or desktop (wide version) devices. Tablets are left somewhere in the middle, adjusting on every device differently to wide or long version, based on the devices' screen resolution.

Tab. 1: General characteristics (average numbers for 1year period)

	The average browser resolution for each type of device	Visits	Bounce rate
Desktop	1490x775	56 %	25 %
Phone	372x563	41 %	30 %
Tablet	971x775	2 %	24 %

Source: Experiment – base characteristics

Type of the device is closely connected to its browser resolution. As we are studying scrolling behaviour in our experiments it is important to work with the size of screen on which the web page content is viewed. Knowing the average browser resolution of our users shows as what part of the web page average user can see without any scrolling. Such imaginary line that divides web page into the viewable content without scrolling and the rest is commonly referred to as page fold. Data about browser resolution were taken from web analytics tool Google Analytics where the average browser resolution for each type of device was counted and set.

Bounce rate, the percentage of visitors who enter the site and then leave without doing any action on the web page. These visitors who bounced were excluded from our experiments and do not affect our collected data.

2.2 Click-through rate

The first part of the research consisted of changes in the text of the buttons and in the text links. Data were collected for 1000 pageviews on 3 webpages, always at least once for each different text on the buttons. There were up to 3 versions of the text in clickable elements tested. The goal of this part of the experiment was to discover which type of the text had the highest click-through rate (in simple terms – which type of the text worked the best).

Another part of this experiment focused on the difference of click-through rates of highlighted buttons compared to click-through rates of paragraph headings. Click-through rates were measured separately for mobile and desktop devices.

2.3 Scrolling

The object of the research in the second part of the study was analysing of how much people are scrolling. There was also comparison of the scrolling on the mobile and desktop version of the webpage. Data were collected for 1000 pageviews on 3 webpages for every experiment. Part of the experiment was change in the length of the web page by adding additional element to the web page just under the page fold and observation of its impact on the scrolling behaviour of people. This new element is visible at the end of the first picture in Fig. 1/ Fig. 2. Finally, we connected experiments with clickable elements together with the scrolling ones and measured relation between placement of clickable elements, in terms of number of people that scrolled to them, and their click-through rates. We used Pearson correlation coefficient to quantify strength of linear relationship that we expected in this experiment.

3. Results of the Research

Our first tested hypothesis was that click-through rate of buttons on the webpage is independent on the text of the buttons (verb in the polite form of address – e.g. “Zjistit více o FPH”, verb in the informal form of address e.g. “Zjisti vice o FPH”, the call to action in form of the noun instead of the verb e.g. “Více o FPH”). To test for the independence, we used Pearson Chi-Square test. By the result of our first experiment was our first hypothesis confirmed. Results are shown in Tab. 2. For all tested cases we do not reject hypothesis of dependence on the significance level of 5 %.

Tab. 2: Button textation experiment - results

	Desktop			Phone		
	χ^2	df.	p value	χ^2	df.	p value
Verb Polite form / Informal form	1.4460	2	0.4852	0.5594	2	0.7560
Noun / Verb Informal form	1.7011	4	0.3633	6.4244	4	0.1293
Noun / Verb Polite form / Informal form	0.2464	2	0.8840	1.6867	2	0.4303

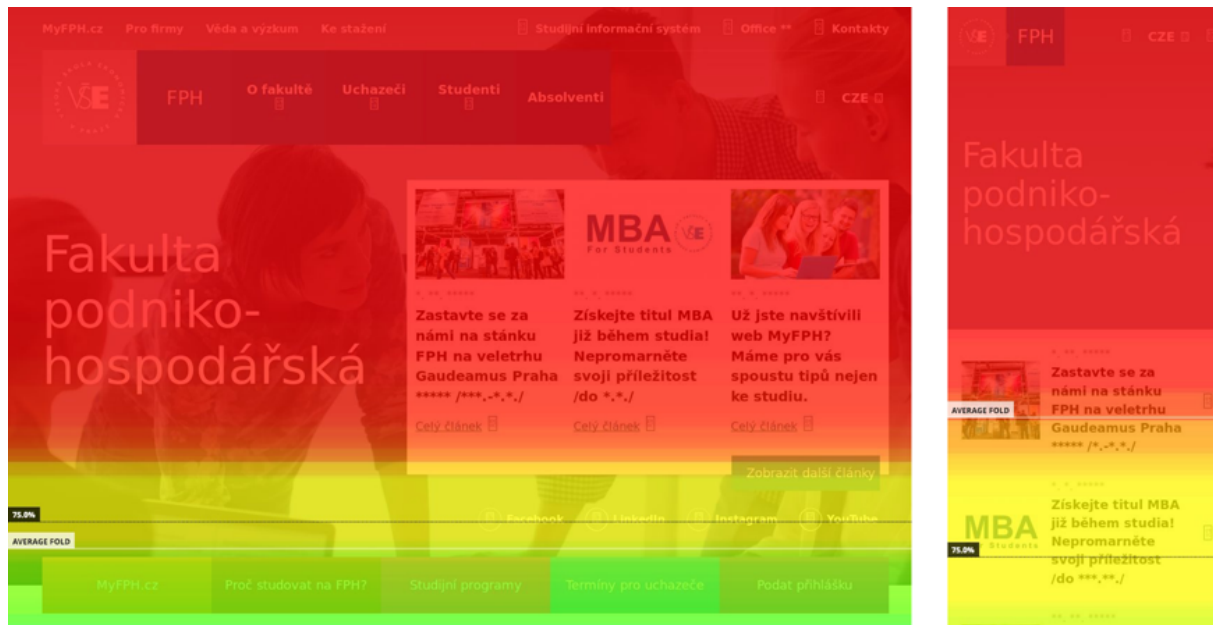
Source: Experiment 1 – results

For experiment with the second hypothesis that click-through rates of highlighted buttons are equal to click-through rates of paragraph headings we couldn't use Pearson Chi-Square test. This was caused by lack of observations of clicking on the paragraphs which violates important assumption of Pearson Chi-Square test. Instead we used Fisher's Exact Test to look for the dependence. We get p value of 0.1003 for desktops and 0.9988 for mobile devices. Our findings indicate that click-through rates are not equal on both webpage elements for both types of devices.

In the experiment regarding scrolling there was focus on the difference of scrolling behaviour on different devices. As it was mentioned before, there is big difference between both in terms of structure and length. Shortened scroll-maps of scrolling behaviour are shown in the Fig. 1, where you can also see previously mentioned difference between “long” and “wide” structure of the web page.

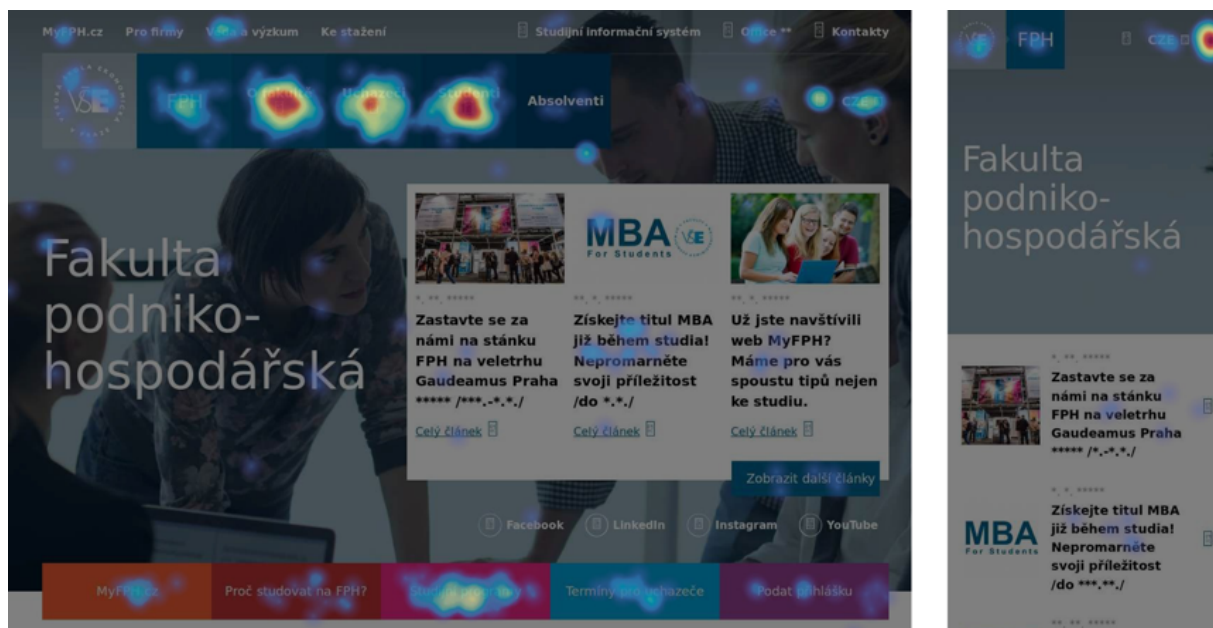
To compensate for different structure, we looked at the relative length of the webpages and compared scrolling behaviour on the adjusted scale. We set the third hypothesis that there is different scrolling behaviour between desktop version and mobile version. There was confirmed our expectation about different behaviour of visitors, based on the results of Pearson Chi-Square test ($\chi^2 = 2103.57$, df. = 19, p value = 0).

Fig. 1: Scroll-maps – desktop / phone



Source: Experiment 2 – printscreen of scroll-map

Fig. 2: Heatmap of click-through rate – desktop version / phone version

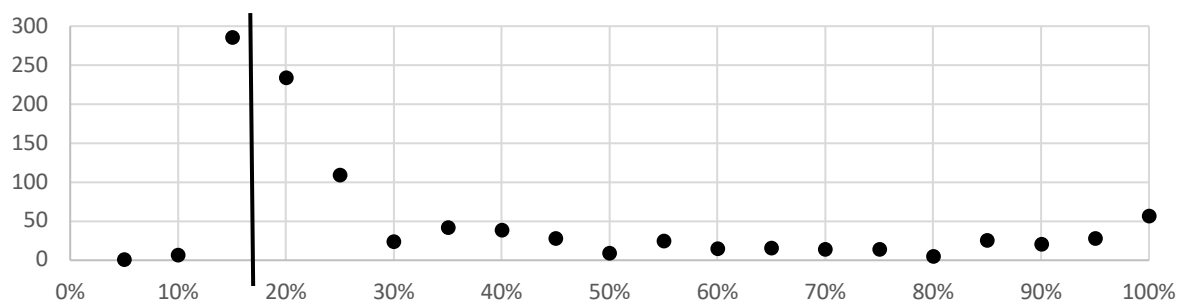


Source: Experiment 1 – printscreen of heatmap

In the next experiment it was added new menu stripe to the website, just below the page fold and measured the scrolling behaviour of visitors with added element and without it. Newly added element is visible in the Fig.1/Fig. 2. Again, it was used Pearson Chi-Square test to get results ($\chi^2 = 203.62$, $df = 19$, $p \text{ value} = 0$). Our experiment confirmed our fourth hypothesis that there is different scrolling behaviour of people on the web page when more website element is added. The fifth hypothesis that there is lower click-through rate with lower placement of the elements on the webpage was confirmed. Correlation

analysis of relative click-through rate and number of visitors on the webpage that seen its clickable elements, based on their scrolling behaviour confirmed our expectations as we observed quite strong positive linear relationship that was measured by correlation coefficient that was equal to 0.77. Dependence of number of visitors on the length of scrolling on the webpage is shown in Fig. 3.

Fig. 3: Dependence of number of visitors on the length of scrolling on the webpage in percentage (desktop) with displayed average page fold



Source: Experiment 2 – scrolling results

4. Discussion

There were tested three versions of the texts of the buttons. Even though the experiments were conducted at the University on young people (majority of visitors were students on the high schools and students at the University), we did not find any proof of the dependence of the influence of the verb in informal form, verb in polite form and noun on click-through rate.

One experiment consisted of testing and comparing click-through rate of two types of clickable elements – Heading and button. We found the evidence of the difference of the click-through rate between clickable paragraph heading and buttons in favour of button.

Our experiment focused on user scrolling behaviour confirmed different user behaviour when scrolling on the desktop and mobile devices. The webpage used in our experiment is nearly two times longer on the mobile devices than on the desktop. We used relative length of the webpage to be able to compare number of visitors and their scrolling behaviour in the devices. The results show that in relative terms users scroll on the mobile devices less than on the desktop (in absolute numbers they scroll more on mobile devices than on desktop).

Even though less user scrolling on the mobile devices, mobile users saw in our experiment more website content. 90 % of the clicks on the desktop were made above the average page fold and 75 % clicks above the average page fold were made on the mobile device. So, by this experiment it was also confirmed that the most important clickable elements should be placed above the page fold in independence on used device.

Throughout analysis focused on user scrolling behaviour, we found out that users scrolled less after adding new component (menu stripe with the links on the other webpages) to the upper part of the website, just below the page fold. By correlation analysis of click-through rate in dependence of vertical position of clickable elements was proved lower click-through rate with lower placement of the elements on the website. In our experiment was proved that more down visitors scroll on the website, less and less clicks they make.

Conclusion

The click on the website through the website element is the action which is measured as the fundamental conversion in most cases. The results of this study can help to optimize clickable elements on the websites and to optimize the length of the website from click-through rate point of view. Optimization of the clickable elements can secondary also increase the conversion rate which is essential for website and business owners to gain profit from their online business.

There are also many other factors which probably influence click-through rate and secondary also conversion rate. The relationship between the order of the elements on the webpage and click-through rate, relationship between number of the elements, absolute number of the clicks and relative click-through rate, optimization of the shape of the element and its relative position, the length of the text in text link or in buttons can be the selection of the topics for further research.

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Economic Efficiency of Internet of Things

Abstract

The article is about the potential of Internet of Things (IoT) and focuses in detail on the cost-effectiveness of IoT. The article analyzes in detail the cost-effectiveness of three select application opportunities of IoT that IoT could improve. It specifically concerns electronic meter seals, the identification of frost on power lines and the localization of persons/equipment. Based on our economic analysis, we have concluded that especially the identification of frost on power lines is cost-effective since its return on investment is less than three years. On the other hand, the use of electronic seals is not cost-effective and has no return on investment, provided that all meters have to be replaced at once. The situation changes in the case that meters are replaced gradually, i.e. as their useful life expires; however, the return on investment is long, taking into account how many meters will be gradually replaced. As to the application opportunity of the localization of persons/equipment, we are unable to clearly prove or disprove its cost-effectiveness.

This article follows up on other, already published articles where we focused on other aspects affecting the implementation of IoT technologies. In this article, we analyze the cost-effectiveness of IoT technologies.

Key Words

Internet of Things, Economic Efficiency, Costs, Benefits

JEL Classification: C21, R13

Introduction

The potential of Internet of Things (IoT - Internet of Things), i.e. specifically applications representing IoT, has very dynamically grown in the past 10 years, which is a result of changes in, and especially the development of, technologies used for IoT applications and a result of the development of energy source technologies. RFID technology (Radio-Frequency IDentification) was historically the main factor in this area; currently there are different solutions that use e.g. a direct connection to telephone networks (LTE, NB-IoT, SigFox, ...) or other mobile devices for communication in real time. Another example is the interconnection of "smart" watches through mobile phones.

The historically first mention about a practical use of IoT technologies came from the food industry where IoT technologies monitored the right temperature of beverages. (Foote, 2018) In recent history, the year 2013 is very important because this is when the IoT concept was developed into a system that interlinks many different technologies and was

defined as a global network infrastructure with self-configuring capabilities. The compatibility of these technologies is ensured through properly defined communication protocols. These protocols have two particularities: physical and virtual ‘things’ are identified with physical attributes, and virtual persons use intelligent interfaces and are integrated into a wide information network (van Kranenburg, 2008).

IoT also includes other versions that are incorporated as a subset of the set called Industry 4.0, i.e. a set of technologies supporting the industrial revolution. As part of Industry 4.0, the IoT concept is called “Industrial Internet of Things” (IIoT – Industrial Internet of Things).

The application of IoT and IIoT technologies is closely connected to two critical areas (Aserkar, Seetharaman, Chu, Jadhav a Inamdar, 2017):

- Cyber risks of wireless data transmission in particular;
- Personal data protection.

These two main areas, IIoT vs. data, are very different. While a secured IIoT communication is the subject of new research and the application of new technologies, personal data security (Novák a Doucek, 2017) is rather connected with procedural management and modeling (Basl a Doucek, 2019).

This article is not about this topic and focuses only on the cost-effectiveness of select IoT solutions.

1. Problem Formulation

The industrial and home use of IoT is currently a very much discussed topic. The use of IoT can be analyzed from many different aspects. One of the critical analyses includes an evaluation of the cost-effectiveness of the use of IoT technologies.

This article analyzes the cost-effectiveness of several select IoT solutions and evaluates whether or not the use of IoT in the given context is profitable.

This article follows up on other, already published articles where we evaluate other aspects affecting the implementation of IoT technologies. In this article, we analyze the cost-effectiveness of IoT technologies.

2. Methods of Research

For this article, we selected the application opportunities of IoT technologies that had been identified from a set of available/existing application opportunities that business and academic experts had found the most interesting. This selection was based on 67 workshops with questionnaires filled out by 50 business and academic experts during

2016/2017. Our workshops were based on the technique of guided questioning, with the use of open and closed questions (Řezanková, 2010).

Based on these workshops, we identified 124 unique application opportunities that were evaluated as to priority and importance. These 124 application opportunities were identified during the first 50 workshops. Their importance and priority were tackled in the following 17 workshops.

Let us add here that:

1. The list of identified application opportunities can always vary, due to both workshop attendance composition and changes in the IT fields within the IoT.
2. The information identified continues to be expanded with the arrival of further analyses and research into the literature, as well as consultations with experts in further areas of research – e.g. ethics or psychology.

3. Results

In this article we focus on the cost-effectiveness of three very different IoT solutions that could be used for different purposes, specifically we focus on the following IoT solutions – electronic meter seals, frost on high voltage power lines and localization of persons or equipment.

3.1 Electronic Meter Seals

An electronic seal can be defined as a simple device that detects resistance on a resistance wire. The resistance wire responds to its interruption, to any successful attempt to shortcircuit it or to any attempt to “bypass” it. Based on the aforesaid, the transmission of information about a broken seal does not require any major data flow. It is a simple message that is usually transmitted daily on the basis of a heartbeat to confirm that the device works correctly. A low-energy IoT network can be used for this transmission (Yuan, Zhao, Li, Zhang, Mei, 2017).

This article provides detailed characteristics of electronic seal use, principles and assumptions (Doucek, Maryska, Nedomova, 2019). Let’s mention that these devices often have the option of automatic transmission of information about the volume of consumed utilities.

3.1.1 Assumptions for our economic analysis

The key assumptions for evaluating the cost-effectiveness of the use of electronic seals for detecting any tampering with electronic seals are as follows:

- a) The average price of the device with an electronic seal is about 2,500 CZK, based on our price analysis of suitable sensors detecting any tampering with electronic seals;

- b) The cost of installation of the device - 500 CZK per device;
- c) Operating cost of the device.

Expected benefits are in particular as follows:

- a) Savings from preventing unauthorized/non-invoiced offtake of utilities;
- b) Reduced costs of inspection of the consumed volume of utilities.

Factors affecting costs and benefits

- a) Let's assume that one person is able to check on average 80 utility meters during one work shift (10 meters per hour during one eight-hour work shift). It is an average number; more meters can be checked in a housing development in cities than in the countryside where it takes several or even dozens of minutes to get from one meter to another. Therefore, one person is able to check about 1,600 utility meters per month, which is about 19,000 utility meters per year;
- b) Let's assume about 500,000 apartments;
- c) The average monthly gross wage, including social security and insurance payments, is 40,000 CZK.

3.1.2 Economic analysis

Based on these assumptions, we can say that at least 27 employees will be needed to regularly check the integrity/volume of consumed utilities. Considering the average wage in Prague, the annual costs will amount to 19 million CZK (taking into consideration the company's costs and disregarding bonuses). To this amount, we must add the cost of transportation between metering stations, the ineffective loss of time, etc. The annual costs may amount to approximately 25 million CZK.

If we change the concept and replace all 500,000 meters with IoT meters, the costs will be extreme – approximately 1.5 billion CZK. Therefore, this solution does not seem to be profitable when considering annual savings of approximately 20 million CZK (the checking of broken seals will continue). However, we must also take into account the potential savings from a timely detection of fraud, the consequent cost of collecting due amounts, potential court fees and legal costs, etc. with detailed knowledge of data.

This situation could be resolved by a combination of advanced data analysis technologies and behavior pattern identification based on the application of artificial intelligence principles, based on which it would be possible to identify the group of customers with a high risk of fraud. In such a case, seals could be installed only on these devices, which would considerably reduce costs. There could be a marketing campaign communicating that the given company has started using modern methods of detecting fraud and that these methods will be used for a certain group of customers.

Conclusion: from a purely economic point of view, an investment into an automatic detection of broken electronic seals (even if automatic consumption readings are added) is not a good investment.

3.2 Frost on High Voltage Power Lines

The IoT technology is important in handling this problem because it allows a proactive approach to potential problematic situations. The use of IoT technologies for frost measuring makes it possible to proactively identify any potential problem in the infrastructure. Anytime a problem is detected, e.g. a thick layer of ice on high voltage power lines, technicians will be sent to this destination to handle the situation (Maryska et al., 2019).

Measuring frost thickness is important especially in the case of long-distance power lines, typically VHV (Very High Voltage) lines. It can be measured indirectly or directly (using tensiometers). The application of IoT technologies is based on the use of meteorological stations that are equipped with ice thickness detectors. These sensors must be present in all critical areas in order to work optimally.

The system is based on the control system that analyzes data from sensors. Analysis results allow the system operator to predict potential problems, to manage the network and to dispatch technicians to the area of potential or actual problems. An alternative solution is to use weather forecasts that, however, are not able to cover all specifics of each measured section of long-distance electric power lines.

3.2.1 Assumptions for our economic analysis

The key assumptions for evaluating the cost-effectiveness of the use of IoT for measuring frost on long-distance power lines are as follows:

- a) The price of the frost measuring device;
- b) The cost of installation of the device with an expected five-year battery life;
- c) The cost of development, configuration and testing of the device;
- d) Operating cost of the device – signal transmission;
- e) The cost of device management – annual costs of servicing and inspection per device.

Expected benefits are in particular as follows:

- a) Savings from lower losses caused by a power supply interruption;
- b) Savings from a more accurate identification of the place of interruption;
- c) Savings in the transportation cost of technicians to the place of interruption.

Factors affecting costs and benefits:

- a) The number of measuring devices (400 pcs);
- b) A historical analysis of frost risks.

Based on an analysis of historical operating data, it is possible to estimate losses caused by frost from total losses as follows:

- a) Prevention of power supply interruptions caused by a layer of ice/snow: a reduction in the number of interruptions by 75% from the total number of losses;
- b) Prevention of power supply interruptions caused by fallen trees: 20% savings from total losses;
- c) Prevention of losses caused by major windstorms (sloping rows of poles): 15% savings from total losses.

Note: the actual economic indicators are not provided since they are a trade secret.

3.2.2 Economic analysis

Based on these assumptions, we can conclude that the investment cost of acquisition and implementation of a frost measuring device can be calculated using the following formula: *the number of measuring devices X (the acquisition and installation cost of a measuring device) + the cost of creation and testing of a comprehensive measuring system.*

Operating costs can be calculated using the following formula: *the number of meters X (communication fees + operating costs + annual servicing cost of a measuring device).*

Benefits mainly include the elimination of losses from unscheduled interruptions of power supply and mainly the elimination of the cost of pro-active physical monitoring of actual frost on long-distance power lines and the cost of repairs of actual interruptions.

Savings from reduced losses can be calculated as follows: *the number of interruptions caused by a certain type of interruption X the average loss for a certain type of interruption X a reduced percentage of interruption.*

When comparing and calculating the costs and benefits of the use of IoT technology for 3, 5, 10 and 15 years, we have discovered that the simple payback period for investments is three years just for the variant “prevention of power supply interruptions caused by a layer of ice/snow.” The application of the remaining two variants shortens the payback period even more.

Conclusion: Considering the fact that the identified payback period is less than three years and the expected useful life of sensors is five years, it is a good investment.

3.3 Localization of Persons or Equipment

Security is another application of IoT technologies that is becoming important. We conducted research on the applicability of IoT solutions in this area from a technological and financial perspective, for details see (Maryska et al, 2018). We focus only on one aspect, which is detection of the presence of employees or equipment in a defined location (Leyh et al, 2016). The ability to clearly detect the presence (or better yet, the position) of employees or equipment in select locations is important especially in extreme situations, such as a mine collapse, landslide, tsunami, etc. Different technical solutions for monitoring work positions help to reduce the risk of casualties.

This application opportunity uses RFID sensors that determine whether or not a certain known RFID device was detected within the perimeter of the sensing device. If a sensor is detected, information about this fact is stored in the database. Based on such data, it is possible to quickly and accurately identify the position of people and equipment at any time. The accuracy of a position or the accuracy of GPS depends on the distance of the sensing devices.

This thematic area is researched not only by academic institutions but also by private companies that test e.g. the use of RFID chips as part of their equipment for employees. etc. (Montanika z.s., 2019).

Depending on the type of application, there are in principle two potential technical solutions.

- a) Measuring in open spaces (method A) that is based on monitoring locations using GPS sensors;
- b) Measuring in open and closed spaces (method B) that is based on monitoring locations using RFID scanners with a modem (these scanners run on battery or are plugged in).

In this article, we focus only on method B, i.e. measuring in open and closed spaces, which is technologically more difficult. For this method, we set the following requirement/assumption: the minimum required time of operation for one battery charging is two years.

3.3.1 Assumptions for our economic analysis

The key assumptions for evaluating the cost-effectiveness of the use of IoT for identifying the positions of measured subjects are as follows:

- f) The cost of a sensing device (based on our research, the average price is about 5,000 CZK per sensing device with a range of 20 meters);
- g) The purchase cost of a chip (the average price of a chip is 50 CZK);
- h) The cost of development, configuration and testing of target equipment;
- i) The cost of device management – annual costs of servicing and inspection of a sensing device;
- j) The number of suitable chips that must be placed on the sensed subject.

Expected benefits are in particular as follows:

- d) A decrease in losses – casualties or equipment;
- e) Savings in the cost of searching for subjects in case of an emergency;
- f) Savings in the cost of keeping manual records of the presence of subjects.

Note: We see the main benefits of monitoring persons with respect to legal requirements for monitoring persons, e.g. in mines, highly risky operations, etc. In all these cases, it is now required to keep records in different forms. The proposed solution considerably simplifies the entire process of record-keeping. The degree of accuracy depends on how many scanners are used in the monitored space.

Factors affecting costs and benefits

- a) The number of sensing devices;
- b) The number of sensed chips.

3.3.2 Economic analysis

Based on our assumptions, we can conclude that the investment cost of acquisition and implementation of a device detecting the position of subjects can be calculated using the following formula: *the number of sensing devices X (the acquisition and installation cost of a sensing device) + the cost of creation and testing of a comprehensive measuring system (including HW costs) + the acquisition cost of a sensed chip X the number of used chips.*

Operating costs can be calculated using the following formula: *the number of sensing devices X annual costs of servicing of a sensing device + the number of sensing devices X the cost of transmission of information about the position of equipment from the sensing device to the database.*

Note: The communication fees may not be part of these costs since e.g. mines may use cable WiFi for communication between a sensing device and an IT infrastructure because a GSM signal is not available in mines, etc.

Benefits mainly include the elimination of losses due to lost equipment, compliance with legal requirements and a higher probability of detecting the presence of monitored subjects in the locations of an emergency.

It is not easy to definitely calculate savings for this variant. Let's image the use of this solution to monitor the position of persons inside a mine. In case of an emergency, such as a mine collapse, we will know with a high accuracy who and what equipment is in the mine and where. The degree of accuracy depends only on the number of sensors. Based on this information, it is then possible to manage and organize rescue works much better.

It is difficult to assign a value to this aspect of benefits of IoT technologies based on our knowledge. Even the respondents, with whom we discussed this topic, were unable to assign a value to this aspect.

Secondary factors:

The reliability of the RFID chip-based solution is an important value factor. This reliability is reduced if these chips are placed e.g. in an employee's helmet, the helmet is damaged and replaced with a new one. For this reason, it is better to consider a multi-chip solution where an employee has an RFID chip not only in his helmet but also in his lamp and access

card, and the signal receipt is required at least from 50% of the RFID chips to ensure reliability. This will prevent problematic situations where an employee lends his equipment to someone else for a short period of time or has his damaged equipment replaced with new equipment for some time.

Conclusion: In this case we are unable to clearly identify the cost-effectiveness or costineffectiveness of the use of IoT technologies. Considering the price of equipment and potential savings, we can, however, conclude that this solution is purposeful and its implementation should be considered since it has the potential to save human lives.

Conclusions

There are many IoT devices that can be used in different areas of human activities. This article analyzed the cost-effectiveness of three select variants.

- a) Electronic meter seals;
- b) Frost on high voltage power lines;
- c) Localization of persons or equipment.

Each of the application areas has its own specifics. Based on our analysis, we are able to prove that in the case of electronic meter seals, it is not cost-effective to immediately replace meters with new meters supporting IoT technologies. Since these meters have their useful life, it is of course worth considering whether or not to purchase modern meters allowing automatic communication/checking when old meters are replaced or additional meters are purchased.

In the case of identifying frost on high voltage power lines, we can clearly prove the costeffectiveness of an immediate investment into these IoT technologies. In this case, we have discovered that the return on this investment is less than three years, while the useful life of the actual equipment (the battery inside the equipment) is five years. This application opportunity entails the installation of devices that detect frost on longdistance power lines and allow to proactively inform the system operator about any risk of interruption of power supply, e.g. due to broken power lines.

In the case of locating measured subjects, we were unable to clearly prove the costeffectiveness or cost-ineffectiveness based on a simple comparison of costs and savings. However, we can conclude that the non-economic benefits of a higher probability of saving human lives in case of an emergency are fundamental and clearly confirm the purposefulness of an investment into IoT technologies. Besides the fact that the position of measured subjects can be immediately identified, there are other major benefits: easy installation, low operating costs and low investment costs. Low investment costs can be expected especially in the situation where the measuring accuracy within a range of 50 meters is sufficient.

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Factors of Entrepreneurial Opportunity and Discovery in the Digital Economy Age

Abstract

In general economic entrepreneurial theories, there are no comprehensive perspectives that would transform the economic approach into the process, and simultaneously offer ways in which a person considering a business venture should be oriented. It is based on the presumption that the economy is in a constant state of imbalance, and that the ongoing economic, political, technological, social and demographic changes create situations in which people can transform resources into forms (new goods and services, new production processes, new materials or new ones) markets), which are worth more than their production costs. The business process begins when an insightful individual, by his own intuition, formulates the supposed existence of a business opportunity. One of the attempts of a general theory of entrepreneurship present a managerial model of the business process and summarizes the results of various authors' research in terms of the influence of identified factors in the various phases of the entrepreneurial process. However, this general theory of entrepreneurship lacks new insights into the penetration of digitization and information technology into business. It means a new division of labor between people and computers and new fields, technologies, business models and forms of business entities. The paper deals with the entrepreneurship concept as the judgment under uncertainty. It extends the managerial oriented entrepreneurial theory, empirically examines the direction and intensity of identified factors in discovering entrepreneurial opportunities and deciding on their use.

Key Words

Entrepreneurship, entrepreneur, entrepreneurial process, entrepreneurial discovery, entrepreneurial opportunity

JEL Classification: L26, M13

Introduction

Entrepreneurship is the foundation of productivity, competition and innovation growth. The issue of entrepreneurship has also gradually penetrated into science and research. While the business area has grown steadily over the past three decades, there has been an "explosion" of business research and education in the industry over the past 20 years. Entrepreneurship has become universally acceptable as an important scientific discipline. Despite previous efforts, the area of entrepreneurship is not uniform. It is characterized by an unfavourably defined paradigm (Shane & Venkataraman, 2000), high fragmentation (Gartner, 2001), lack of development theory (Morris et al. 2001). There is lack of conceptual framework. Many theories or frameworks do not rely on a justifiable

theoretical basis (Bull & Willard, 1993). There seems to be an endless discussion among researchers in this area about the definition of entrepreneur (Bygrave & Hofer, 1992; Gartner, 1990) and the classification of the discipline. By the beginning of the 21st century, entrepreneurship theory has gained more attention in academic literature (Endres & Woods, 2006; McMullen & Shepherd, 2006; Murphy et al., 2006). The main recurring themes in the literature on entrepreneurship have been identified as (i) discovering and exploiting entrepreneurial opportunities; (ii) knowledge; (iii) uncertainty and risk; (iv) market as a process; (v) disequilibrium; (vi) alertness.

The goal of this paper is to extend existing managerial theories of entrepreneurship by new elements (factors, partial processes, tools, methods) resulting from the new division of labour between people and computers and from new fields, technologies and forms of business, as well as new forms of business entities in the era of digital economy. In this paper we are trying to answer the following research questions:

4. How does the intermingling of human (entrepreneur) and material (digital) factors affect entrepreneurship theory?
5. What new forms of business entities can be expected in the digital business era?
6. What new factors, resp. changes in existing factors can be expected when discovering and judgment of entrepreneurial opportunities and deciding on their use?
7. What will be the direction and intensity of the identified factors in discovering entrepreneurial opportunities and deciding on their use?

1. Theories of Entrepreneurship: State of the art

As a rule, economic theories do not explain the concept of entrepreneurship in an economic context. Classical economics basically neglected entrepreneurship. Neoclassical economics based on a competitive model of general equilibrium eliminates entrepreneurs and takes it for granted. Results of the equilibrium model are inconsistent with the entrepreneurial process. Many scientists question the ability of neoclassical economics to clarify or understand entrepreneurship (Baumol, 1993; Kirzner, 1997) because of the dynamic nature of the entrepreneur. Neoclassical conception considers entrepreneurs simply another factor of production (Endres & Woods, 2006).

Schumpeterian approach rejected the emphasis of neoclassical economics on a perfect competitive market and emphasized entrepreneurs and the dynamics of the competitive process. Schumpeter considered entrepreneurs as leaders in innovation. The entrepreneur promotes new combinations or innovations that disrupt the equilibrium. This entrepreneur promotes disequilibrium, and the author calls it "creative destruction," carried out either through "new combinations" or innovations. Schumpeter considers the market dynamic compared to the static approach of the neoclassical model (Hébert & Link, 2006).

Austrian School of Economics (ASE) plays an important role in developing the economic theory of entrepreneurship. ASE economists share the belief that neoclassical approaches fail to present a "sufficient theoretical framework for understanding what is happening in a market economy" (Kirzner, 1997). ASE economists see entrepreneurs as a market

economy driver. Austrian most important economist in the field of entrepreneurship is Israel Kirzner. He considers entrepreneurs to be alert and willing to perceive profit opportunities, and if he is right, he will make a profit (Kirzner, 1973). He emphasizes that the universal theory of economics sees the market as a process that aims to equilibrium, but never reaches it. Kirzner considers the market to be the process of discovery and "alertness" of individuals as a feature to identify and exploit entrepreneurial opportunities. Kirzner's entrepreneur acts constantly under uncertainty conditions (Douhan et al., 2007).

Modern economic theories of entrepreneurship, evolving over the past 20 years, are influenced by various disciplines such as psychology, sociology or history. Recently, there has been some research of entrepreneurship within the economy, but only extended the managerial perspectives (Shane & Venkataraman, 2000; Shane, 2003; Foss & Klein, 2002, 2012). Complex managerial perspectives in entrepreneurship theory, which transform the economic aspect into the process level and at the same time offer ways to guide a person thinking about entering a business are not part of a common economic literature. One of the important sources of such an approach is the attempt at general theory of entrepreneurship (Shane, 2003). Here, the author presents the entrepreneurial process model and summarizes the research results of various authors in terms of the effects of identified factors in the individual six stages of the entrepreneurial process model. There is no mention of research in the scientific literature, including a comprehensive expert empirical assessment of the directions and intensity of identified factors. Recent papers (Welter et al., 2017) call for a wider and nondiscriminatory perspective on what constitutes entrepreneurship to find a better theory and more insights that are relevant to the phenomenon entrepreneurial diversity. In addition, there are no new perspectives related to the penetration of digitization and information technology into entrepreneurship in the presented general theory of entrepreneurship. These are phenomena such as the new division of labour between people and computers and new disciplines, technologies and forms of business, as well as new forms of business entities in the digital economy era.

Renowned scholars of the theory of entrepreneurship, as noted in the previous paragraph, have clear discontinuity between entrepreneurship and business. It is a fragmentation between two areas where the identification of profit opportunities is separated from the exploitation or realization of such opportunities in the sense of gathering resources for practical governance of opportunities. The appropriate process of acquiring and organising resources for realizing opportunities is seen more as a domain of disciplines such as business strategy, business economics, or corporate organization than something that is part of the entrepreneurship (Hučka, et al. 2011). On the other hand, managerial theories of organization and strategy, even though they pay substantial attention to the knowledge aspects of entrepreneurship (e.g. Shane, 2003), tend to consider opportunities given as soon as the resource-gathering process is initiated.

To sum up, the approaches taken so far in both theory of entrepreneurship and management consider the discovery of opportunities as an event separating the two different degrees of value creation: one about the processes through which opportunities are perceived, evaluated and then transformed into plans, and the other in which the formulated plans are implemented through employment of resources. The separation of the two stages of the value creation process, according to the investigators, is artificially

induced. Entrepreneurial profit opportunities that are waiting to be discovered and exploited only come into existence, when they are materialized through a forward-looking entrepreneurial action.

2. Research of factors of entrepreneurial process

The aforementioned theoretical background lead to the concept of entrepreneurship as a judgment under uncertainty in the spirit of Knight (1921), Mises (2006) and Kirzner (1973, 1979). In this concept, entrepreneurs act as decision makers with their own assets. They invest resources to start a new business based on assessing future market conditions. The role of the entrepreneur is to prepare an adequate business strategy for the successful use of the discovered opportunity in terms of uncertainty and information asymmetry, and to organize own assets in procedures and structures which combine them into meaningful market outcomes. This concept will be the starting point for our research approach. The aim is to propose a theoretical model of the entrepreneurial process in the spirit of judgmental decision making under uncertainty and support it by our own research. Such model will be also related to business semantics and process modelling (Vymětal et. al, 2008). The model should combine the six research themes outlined in the following paragraphs, which include new perspectives related to the penetration of digitization and information technology into business.

The theoretical model of the entrepreneurial process is based on Shane's core business components (Shane, 2003). At the conceptual level, the entrepreneurial process model framework can be portrayed as a series of steps that will be initiated by the entrepreneurial intuition about the existence of an entrepreneurial opportunity and which will end with the fact that the use of the entrepreneurial opportunity is exhausted. The flow chart is shown in the left column of Tab. 1. Accordingly, the entrepreneurial process is divided into the following six steps:

8. Discovery of entrepreneurial opportunity;
9. Decision to exploit opportunity;
10. Resources acquisition;
11. Entrepreneurial strategy;
12. Organizing process;
13. Opportunity exploitation.

3. Research approach

Research will be focused on validity of conceptual model (see Tab. 1) factors, intensity of their influence, relationships among the factors, reasoning behind identification of unimportant factors and use of the most important factors in the model. There are three closely related fields of study in entrepreneurship: entrepreneurship (corporate and individual), small and medium sized enterprises and family business (Veciana, 2000). There are several theoretical approaches to the study of entrepreneurship which can be categorized based on the level of analysis: micro (individual), meso (corporate) and macro (country or global) as noted by Veciana (1995). The macro level analysis is

coherent with Kirzner's and Schumpeterian entrepreneur theories based on Austrian school of economics. The decision to create firm can be studied on the micro-level. This involves study of basic factors (antecedents, personal attributes, incubator and overall business environment) and following decisions based on random situations (dissatisfaction, critical events etc.) or arising opportunities or needs (Veciana, 2007). Also there are approaches that apply evaluation tools to investigate performance of new ventures (Peterková et al., 2015; Franek, 2017).

4. Results of the Research

As a rule, the individual steps (partial processes) take place in the given sequence, but feedback loops may occur due to information asymmetry and uncertainty (not shown in the table Tab. 1.). For each step, the table summarizes the factors that, according to various empirical surveys conducted in previous periods (see Shane, 2003), influence the likelihood of discovering, exploiting, or realizing entrepreneurial opportunities adequately by step (see table middle column). Finally, in the right-hand column, the individual changes are assigned, at the hypothetical level, the likely changes and new tools that could facilitate and support the success of the steps of the entrepreneurial process in the digital economy age.

Particular steps were also a subject of partial research by several scholars (Blackburn, De Clercq & Heinonen, 2018). In the process of finding relevant factors we have reviewed following recent studies on: opportunity discovery (Pioch, 2019; Forest, 2018); opportunity decision and evaluation (Choi & Shepherd, 2004; Welpé et al., 2012; Maine, Soh & Dos Santos, 2015; Gruber, Kim & Brinckmann, 2015), resources acquisition (Zhang, 2010; Maritan & Peteraf, 2011; Wernerfelt, 2011, Huh, Kunc & O'Brian, 2013), entrepreneurial strategy (Hitt et al., Special Issue, 2001; Lechner & Gudmundson, 2014, Garg & Eisenhardt, 2017), organizing process (Wiklund and Shepherd, 2008), opportunity exploitation (Zahra et al., 2005; Companys & McMullen, 2007; Choi, Levesque & Shepherd, 2008; Young, Levesque & Shepherd, 2008; Foss, Lyngsie & Zahra; 2013). Important part of the study of factors related to the entrepreneurial process is the entrepreneurial ecosystem (Isenberg, 2010; Feld, 2012; Nambisan, 2013; Acs et al. 2017; Stam & Spigel, 2018, Acs et al., 2018).

Tab. 1: Conceptual model of entrepreneurial process, factors and tools

Entrepreneurial process	Factors	Changes and new tools in the digital era
<pre> graph TD A([Opportunity intuition emerged]) --> B[Discovery of entrepreneurial opportunity] B --> C[Decision to exploit opportunity] C --> D[Resources acquisition] D --> E[Entrepreneurial strategy] E --> F[Organizing process] F --> G[Opportunity exploitation] G --> H([Opportunity exhausted]) </pre>		
	Technological changes Political change Regulatory changes Socio-demographic change Entrepreneur Experience Ability of the entrepreneur	Changes in the digital environment (digital changes) Software support for business intuition Software support for exploring business opportunities
	Economic factors The entrepreneur's education and experience The age and social status of the entrepreneur Aspects of the entrepreneur's personality Entrepreneur self-esteem Cognitive characteristics of the entrepreneur Sectoral differences	Software support for decision making about opportunities Digital environment
	Institutional environment Resources Acquisition Barriers self-financing Contractual solutions Pre-investment instruments Post-investment instruments Business planning Entrepreneur quality and opportunities	Network acquisitions of IT professionals Digital fundraising Digital acquisition of information resources
	Barriers of competition Building a reputation Keeping the lead Small scale growth Acquisitions Specialization Alliance	Superfast dissemination of new product offerings Political agreements
	Use of opportunity Hierarchy versus market Legal entities Company size A selection of employees Organizational structure and processes Standard realization activities	Virtual forms of organization Business forms without material capital Robotics Freelancing
		Types of knowledge work Comparative technology Business based 3D printing Digital technology Decentralized technologies

5. Discussion

In this paper, a conceptual framework for entrepreneurship based on the approach of the Austrian School of Economics was presented. Such research should be oriented interdisciplinary from an economic, psychological and sociological point of view, as a

business as a very specific phenomenon can theoretically be clarified only from multiple perspectives of science.

What are the specific areas of business with the greatest need for research? Since no empirical research has been carried out in the Czech environment so far in the sense of our approach, we can say that we are at its very beginning. Therefore, we are confining ourselves to a few questions that seem to require the greatest scientific attention:

- a) information on the resources and forms of business opportunities,
- b) personal characteristics and motives of entrepreneurs,
- c) mechanisms used by investors to acquire resources,
- d) use of different strategies in relation to the use of business opportunities,
- e) ways to overcome the problems of uncertainty and information asymmetry,
- f) exploring organizational forms through which opportunities are exploited.

Research in business also requires changes in research methods (Shane, 2003). Entrepreneurship is a dynamic process and therefore the methods used should take this dynamics into account. In this context, emphasis should be placed on researchers, in particular, developing hypotheses and testing them before focusing on mere data collection. The dynamic way of surveying will have to respond to the fact that most business activity is episodic, short-lived, and generally involves selection (Shane, 2003).

Conclusion

ASE's approach to business emphasizes entrepreneurial function and entrepreneurial discovery of opportunities. This is connected with the existence of opportunities, the types of opportunities, the resources of opportunities and the place to exploit opportunities. According to ASE economists, entrepreneurship can evolve as a science and be based on the laws of cause and effect when it has the correct theoretical basis. While Schumpeter has greatly influenced business and economics, attention has shifted to Kirzner's business theory. It should be based on the general theory of human behavior. The theory can be seen as a business process, divided into six steps, starting with the discovery of a business opportunity and ending with this opportunity. The outlined conceptual framework requires proper theoretical research supported by empirical research. Summing up the above mentioned ideas, we can also say that without the process of entrepreneurial discovery, market understanding and competition is severely limited. Only active market activity of entrepreneurs ensures simultaneous process of corrective activities. Only a business understanding of the market process allows one to fully understand the nature of the market system and the order it creates.

The presented conceptual framework based on latest literature review is focused on the development of business proces according to new paradigms stemming from the digital economy. It has created new busienss environments and exploited opportunitites that are being uncovered. Future entrepreneurs will should be aware of the whole proces and adapt to new challenges that particular changes have brought.

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Digitalization: transforming the nature of HRM processes and HR professionals' competencies

Abstract

In these days, a key topic of HR managers discussed in daily activities of human resource management (HRM) is digitalization in HR. It can help optimising processes, modernized HR function and improved the employee and candidate experience. HR's digital transformation becomes a revolutionary opportunity to change overall digital enterprise strategy and culture, prioritizing real-time HR operations, automation and mobile-first. Enterprises need to adopt to a changing way of working and HR skill requirements in order to remain competitive and reap the full benefits of digitalization. The paper aims to introduce the topic in the literature, present key benefits and risks of this trend and analyses the influence of digitalization on HR professionals' competencies on data collected in European Digital Skills Survey (2016) which evaluates using of informational and communicational technologies (ICT) and digital skills in the workplace on the opinion of more than 7,000 respondents in six EU member states (Germany, Finland, United Kingdom, Portugal, Sweden and Slovakia). In this part of the paper information related to positions in human resources were identified and analysed to show current trends in HR professional competencies. Findings in the paper confirmed importance of digitalization for human resources and changes in HR competencies for the future.

Key Words

digitalization, human resource management, hr competencies, digital skills

JEL Classification: O15, J24

Introduction

The global phenomenon of digitalization and robotisation is having a significant impact on the world of work and on job markets. Today's enterprises are forced to deal with the constant flow of new technologies and information, new employment forms, fast digitalization of the workplace and changing demand for employee's skills, that encourages them to rethink the way they manage a workforce. In this case HR functions play an essential role for leading changes and adding strategic value to the company at the digital age (Bokelberg, Dorai, Feinzig, et al., 2017). Overall, basic digital skills are seen as at least somewhat important for almost all the jobs (Curtarelli et al., 2016).

Rapid advancement of digital technologies, such as artificial intelligence, cloud computing, Big Data, robot process automation, social media, real-time communication and increasing use of virtual reality, are bringing the new functionality to the HR department. As a result, a digital transformation influences the way HR functions are fulfilled through using digital tools and apps in order to innovate processes, make decisions and solve problems (Manuti, de Palma, 2018). Digitalization requires new HR competencies, which will help to create a culture of innovation and productivity at the workplace and manage people in more agile, flexible and personalized manner (Amla, Malhotra, 2017). The aim of the paper is to introduce the aspects of digitalization and robotisation in the work of HR practitioner, identify positive and negative aspects of this phenomenon and also introduce selected findings about influence of digitalization on HR competencies.

1. Digitalization and robotisation: Challenges and opportunities for HRM

The first mention of the term «digitalization» is attributed to Robert Wachal, who used it in the sense of «digitalization of society» in 1971 and explained its origin as the result of more widespread use of digital technologies (Pieriegud, 2016). According to Kagermann, H. (2015) digitalization may be defined as the networking of people and things and the convergence of the real and virtual worlds that is enabled by ICT. Brennen J. S. and Kreiss D. (2016) point out that digitalization is based on the adoption or increase in use of digital or computer technology by an organization, industry, country, etc. This led to a situation where ICT have caused the restructuring many areas of social life.

Digital transformation is becoming a hot topic for companies worldwide. The need to adapt to the new conditions of the global business environment and the growth of digital innovation leads to the fact that companies are forced to change ways of working and then reshape their business model. Implementation of integrated strategies that focuses on finding new talents, professional development and retention of current employees in the company is crucial to the success of the digital transformation of human resources. In this sense, the HR becoming a strategic partner of the company in order to ensure the long-term competitive advantage of the company in the era of digitalization (Ulrich, Dulebohn, 2015).

The emergence of the concept "digital HR" is the result of fundamental changes in the approach to HRM over the years. In the 60s and 70s the main goal of HR managers was to process and analyse employee information and automate their daily activities. In the 80's the personnel department is becoming an organization that provides professional consultancy and responds to the needs of individual employees. From the early 90s to the 21st century HR functions are focused on talent management and the implementation of new electronic systems to support recruitment, learning, performance management and employee remuneration (Volini, Occean, Stephan, Walsh, 2017). In the 21st century, HR has the possibility to revolutionize the experience of employees by the transformation of HR processes through the use of new digital platforms, applications, and methods of providing HR services including digital communication (Stephan, Uzawa, Volini, Walsh, Yoshida, 2016).

Using of technologies in HR brings merits and demerits to HR specialist as well for the whole organisation. Some of these are often mentioned both as benefits but can be considered also as potential risks. The following tab.1 shows both benefits and risks of digitalization for HR:

Tab. 1: Key benefits and risks of digitalization in HR

Benefit (merits) of digitalization in HR	Risks (demerits) of digitalization in HR
Better quality with fewer human errors	Employees' unwillingness to embrace new technologies (resistance to change)
Increased operational efficiency	Replacement by the automation
Cuts of HR costs	Cyberattacks (personal information leakage)
Speeding up HRM processes	Data security
Data security, improving decision-making process	Changing business model, organizational structure, employee-employer relations
Reliability and transparency of data	Data integration of separated IT systems
Improving the overall employee experience	Digital tools available for HR still not fully utilizing
Driving business growth (competitiveness)	Slow transformation of HR competencies
Empowerment of HR department (role of the strategic business partner)	Lack of investment in training to support HR digital skills
Embracing the digital talent lifecycle	

Source: own elaboration based on (Alma, Malhotra, 2017), (Bokelberg, Dorai, Feinzig, et al., 2017), (Paychex, 2018) and (Velthuijsen, Van Tol, Hagen, 2017)

HR departments has a strategic value added in the understanding challenges companies face in relation with Industry 4.0, helping to identify which staff could be affected by automation, and create a culture in which work is subject to change. Together with new technologies HR professionals more often face with large volumes of data in different spreadsheets, lack of functionality of IT systems and an insufficient user experience, what has resulted in developing challenges in recruiting, retaining and engaging employees. It is important to emphasize that current competencies and roles of HR are no longer sufficient and don't correspond to their changing responsibilities.

Huong Vu (2017) has identified in his study human resource competencies as skills, abilities or personal characteristics needed by HR professionals to achieve their high performance. It also has been argued that HR professionals with the right competencies will perform better their job role. Another study (Lo, Macky, Pio, 2015) emphasizes distinction between strategic HR competencies, which include business knowledge and active involvement in strategic decision-making, and functional HR competencies related to the delivery of HR operations, personal credibility and active use of HR technologies.

The ongoing development of HR technologies creates new tasks and roles for HR professionals and motivates them to develop strong HR technology competencies. Tab. 2 shows the evolution of the human resources competencies, which under the influence of digitalization shifts from traditional to digital HR competencies and technical skills.

Tab. 2: Traditional HR competencies versus digital HR competencies

Traditional HR competencies	Key Digital HR competencies
Relationship management (consultation)	Digital literacy
Ethical practice	Digital communication (social media)
Business acumen	Data analytics and cloud technologies
HR expertise knowledge	Dealing with complexity (multitasking)
Workforce planning and change management	Working in agile way, creativity
Diversity management, cultural awareness	Lifelong learning (skills development)
Critical thinking	Problem-solving (digital solutions)

Source: own elaboration based on (European Round Table of Industrialists, 2017) and (SHRM, 2012)

The research provided by Ulrich D. et al. 7 times since 1987 through interviewing around 100,000 respondents has confirmed that key HR competencies are actually associated with the environment requirements and they are changing over time. The latest study (2016) with over 31,000 HR participants from all over the world identified new 9 core competencies that are critical to the development of HR specialists at the digital age. These competency domains include Paradox Navigator, Human Capital Curator, Total Rewards Steward, Credible Activist, Culture and Change Champion, Strategic Positioner, Compliance Manager, Analytics Designer and Interpreter, Technology and Media Integrator. One of Ulrich et al.'s (2016) key findings is that HR professionals are seen as having less competence in Technology and Media Integrator which may indicate the relative newness of this competency domain.

From the analysis of the literature, it is possible to identify changing role of HR professionals caused by digital disruption. It appears that HR professionals need to be digital-ready in order to strengthen their position in business and revolutionise the employee experience by incorporating people, HR technologies and processes in new

digital ecosystem. It means being prepared to embrace digital technologies and having the necessary awareness, skills and resources to use them to meet current employee expectations, improve business flexibility and increase its efficiency (Patmore, Somers, D'souza, Welch, Lawrence, 2017).

2. The influence of digitalization on key HR professionals' competencies and skills: secondary data analysis

Certainly, digitalization causes changes in structure of employment, ways of working and company's expectations from employee's skill sets, which brings to the need of the skill revolution. As it was pointed out by the PwC study, around 5% of UK jobs will be in field of artificial intelligence, robotics or new appearing technologies by 2030s. Therefore, the role of HR becomes crucial for encouraging workers' new behaviour, identifying skills gaps and retraining talents in rapidly changing technology landscape. Correspondingly, HR first of all has to be creative, innovative and technology-savvy in order to improve employees' experience and business outcomes (Velthuisen, Van Tol, Hagen, 2017).

Paychex Pulse of HR Survey (2018) revealed that using digital technologies by HR managers is helpful not only for improving recruiting and regulatory compliance, but also allows them to play a strategic role in decision-making process and company's success in general (Paychex, 2018).

In a study of Patmore et al. (2017) 268 UK HR professionals were questioned about technology readiness, digital mind-set and their level of digital skills. It has been claimed that only one from seven respondents identified his HR team as an expert across a range of digital skills in the area of social media, mobile, analytics, data, digital learning and user experience. This emphasizes that majority (61% poor to average) has digital skills gaps, using digital analytics is the biggest from them (Patmore, Somers, D'souza, Welch, Lawrence, 2017).

The study provided by Infocorp at the request of ManpowerGroup in 2017 examined the influence of automation on the workforce by surveying around 20,000 employers in 42 countries. This study found that employers worldwide faces challenges in looking for people with mixed soft, technical and digital skills, which allows to reduce the risk of replacement by the automation. Another relevant point is that more than half of companies indicated communication, problem solving and organization as HR specialist's soft skills, which is the hardest to find in the digital era (ManpowerGroup, 2017).

The Global Leadership Forecast released by DDI, the Conference Board and Ernst & Young in 2018 focused on the state and context of the future of leadership. The survey was based on data integrated from 25, 812 leaders and 2,547 HR professionals from 54 countries. According to this report new business models, organizational structures, analytics and digital disruption impact on the HR roles and actions to build their competence and credibility. The research found out that about 70% of HR specialists see a need to increase their applying both HR technology and analytic skills. Moreover, only 16% of HR leaders felt very prepared for operating in highly digital environment (Wellins, Sadjady, 2018).

3. Trends of digitalization of HR: European Digital Skills Survey

Based on the European Digital Skills Survey carried out among a representative sample of 7,800 workplaces in six EU member states (Germany, Finland, United Kingdom, Portugal, Sweden and Slovakia), there can be identified some trends in digitalization in positions of HR specialists. Although HR managers were mainly in the position of respondents in this survey, several questions also indicated some findings about influence of digitalization on HR ICT competencies. Searching for findings about HR managers there were identify these finding is this study. As the table 3 shows human resource managers were between occupations which were selected as the most important for day-to-day operations by sector and by type and level of digital skills of employees in selected jobs, however only basic digital skills of HR manager were identified as essential comparing all other positions listed below where also some level of advanced or specific digital skills are needed.

Tab. 3: Occupations selected as the most important for day-to-day operations by sector and by type and level of digital skills of employees in selected jobs

Sector	Rank	Job title	Basic digital skills	Advanced digital skills	Specialist digital skills
Information and communication; Professional, scientific and technical activities; Administrative services	1	Managing directors and chief executives	4	2	2
	2	Clerical support workers not elsewhere classified	4	1	2
	3	Sales and marketing managers	4	2	2
	4	Accountants	4	2	2
	5	Information and communications technology service managers	4	4	2
	6	General office clerks	4	1	2
	7	Finance managers	5	2	2

	8	Engineering professionals not elsewhere classified	4	3	2
	9	Software developers	4	4	2
	10	Human resource managers	5	1	1

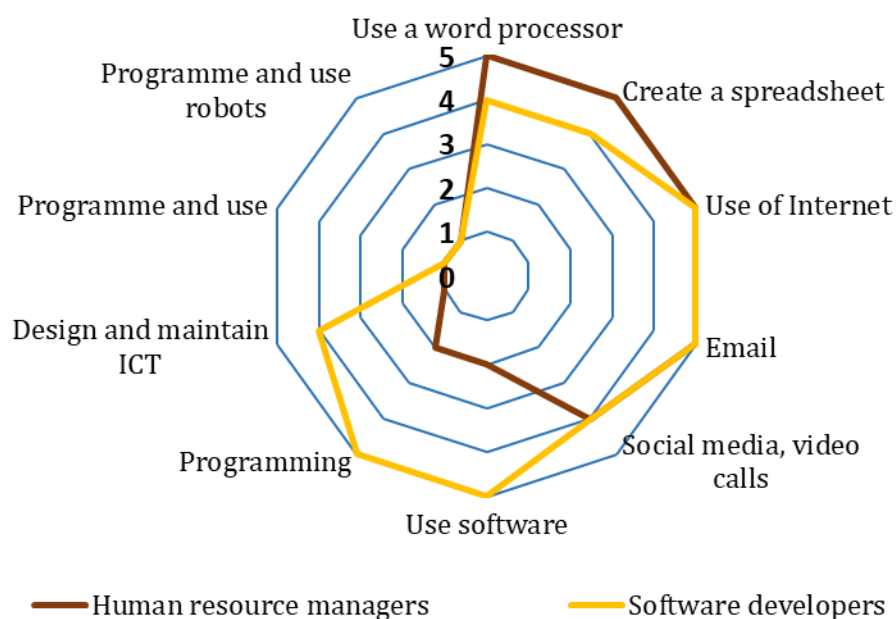
Source: own elaboration based on Curtarelli, M. et al. (European Digital Skills Survey 2016)

Note: 1 means not important at all, 5 means essential.

As findings from this survey confirm these workplaces are more likely to be expecting further changes brought by digital technologies in relation to all the jobs selected. From 6,264 valid responses in the next question there was also found out which digital skills are the most important for HR managers. Figure 1 introduces key digital skills for HR managers and software developers (where 5 essential and 1 not important at all). As the figure 1 shows for HR managers essential digital competencies are using of word processor, creating spread sheets, using internet and e-mail. Also, social media and video calls were identified as very important. Also, some level of programming starts to have an importance for HR managers. For comparison authors selected software developers (from the same sector Information and communication; professional, scientific and technical activities). For software developers, also using software and programming is essential.

Future perspective of using of digital skill on the position of HR was also evaluated by this survey. HR managers were those identified as one of the key groups influenced by digitalization in the past and also near future. However, from 10 selected occupations in the sector of Information and communication; professional, scientific and technical activities respondents identified that in last 5 years there was no change in ICT use in case of HR managers. Also, it is quite surprising that they expect no changes at all in 20% of cases for using ICT in HR manager positions. Comparing to these authors selected financial managers where significantly more changes were reported in the last 5 years and also in next 5 years (see Tab. 4).

Fig. 1: Comparison of importance of digital skills in selected jobs



Source: own elaboration based on Curtarelli, M. et al. (European Digital Skills Survey 2016)

Tab. 4: Use of ICT in LAST and NEXT five years, by sector and occupation

	Last 5 years		Next 5 years	
	No change at all	Changes reported	No change at all	Changes reported
Finance managers	8.1	91.9	2.9	97.1
Human resource managers	16.7	83.3	20.0	80.0

Source: own elaboration based on Curtarelli, M. et al. (European Digital Skills Survey, 2016)

Discussion

Findings from this survey demonstrate that the power of digital transformation is only beginning to emerge and HR tends to be slightly late to the party of technology adoption. Despite the fact that the new world of digital HR is progressing rapidly, the Stephan et al. research (2016) of digital HR's importance shows that each third company defines it as very important priority and only 9% of enterprises believe they are fully ready for it. The other study of the human value in the digital age (2017) conducted by Velthuijsen et al. emphasizes increasing demand on higher-educated skill sets in the near future, such as social and creative intelligence. According to the Patmore et al. research (2017) learning and development (51%), performance management (45%) and onboarding (44%) are planning to be supported digitally in the following period. At the same time HR analytics being the biggest weakness out of the organizations surveyed. In order to effectively solve current business problems and support productive change, collaboration and leadership in future, HR need to be able to use integrated analytics and technology to improve decision-making and maximize their contribution to organizational success.

In the paper there was used data from the European Digital Skills Survey (2016) gathered in six EU member states. As a result, findings of this study cannot be generalized beyond those countries and it is limited also to the sample size defined as 7,800 employers. This topical issue gives the space for authors to continue in the further research in this topic.

Conclusion

Digitalization represents a major challenge for employers, workers and public authorities, and the challenges needs to be fully understood in order to identify the most appropriate policy options to transform them into opportunities for all (Curtarelli, M. et al., 2016). The influence of digital technologies has an impact on competencies required in different jobs and changing of the extend how they are currently used in workplaces. The paper aims to analyse how digitalization influences also competencies in HR and how digital skills are needed and used by HR managers. The findings in the paper based on the literature review and presentation of some finding of European Digital Skills Survey (2016) showed increasing demand for digital skills in recent years in many jobs. It is expected to continue growing due to the increasing number of jobs requiring employees to use ICT and possess digital skills. In the paper there are identified merits and demerits of digitalization in HR. In case of jobs in HR digital competencies are more and more important and positions of HR managers were identified as those where the trend of growth of importance in digital skills will grow in next 5 years. Not only using of the Internet and working with computers but also using and social media has become an essential part in HR.

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The Minimize of Employee Error or Fraud by Help of Compliance Management System

Abstract

The Compliance management from legal point plays a significant role in prevention the data abuse from information system, which are caused by the organization's employees. The implementation of Compliance management system, as part of information system of organization, represents the extension of the functionality of information system by help the tools and procedures which establish the juristic, ethical and others necessary rules in the company. The paper deals with the concept of Compliance management system, which is based on Deming's PCDA cycle, Segregation of Duty matrix matrix and database that manages authorization and authentication requirements of user's roles in processes of organization. The concept of Compliance Management system design is illustrated by a case study.

Key Words

Deming's PDCA Cycle, Segregation of Duties Matrix (SoD), Authorization, Authentication, Information Security Management System (ISMS)

JEL Classification: G32, D73, D83

Introduction

Integrity and compliance of data are not only the basis but also an opportunity of a successful and sustainable organization. Compliance management should, while maintaining its independence, be integrated in to all organization processes as is defined in (ISO 19600, 2014).

The legal aspect of Compliance management plays a significant role and has become the main reason of Compliance management creation. In particular, the 3 main following documents contributed:

1. *American law Sarban-Oxley* that deals with transparency and accountability for accounting information of organizations and formulates requirements for how to record, track and report financial information. This law also implements a framework COSO (Committee of Sponsoring Organizations of the Treadway Commission) that understands the internal control as a process involving both management and other staff of the organization. The effectiveness of the organization can then be assessed by COSO in three categories, depending on whether the owners and management of the company have reasonable assurance that:

- a) understand the extent to which the company's goals are met;

- b) the published financial results of the company are credible;
- c) achieved the compliance with applicable legislation.

2. *British law Bribery Act* that deals with corruption in the UK.

3. *Output document BASEL II* of the Basel Committee on banking supervision which is focused on dealing with risks in banking. This standard has primarily impact on banking information management. The BASEL II framework is structured into three pillars:

- a) *Minimum capital adequacy* that formulates the rules for calculating the required capital and the risk measurement method. This pillar covers credit, market and operational risk.
- b) *Supervision process* that strengthens supervisory powers, and on the basis of the risk profile, the bank regulator sets the limits for the capital adequacy of individual banks.
- c) *Market discipline* that sets out the requirements for providing information about the risks of banks and financial institutions to the public.

The above-mentioned documents have contributed to making organizations more legal for their employees. If the organization fails to show sufficient effort in receiving the control and preventive measures against the criminal behavior of its employees, then this organization becomes responsible for such behavior. When is Compliance management system implemented into organization, it is also necessary to consider:

- a) Internal regulations of the organization.
- b) The experience of the organization's employees.
- c) Level of organizational culture.

Compliance management system (CMS) is a modification of the Information Security Management System (ISMS) which is based on Deming PDCA cycle and is extended by supporting activities (Kozel et al, 2018). CMS consistency with other management systems (see Figure 1) is based upon the continual improvement principle (Plan, Do, Check, Act). Support activities are iterative by all steps of the PDCA model, and the organization should provide appropriate support within the CMS lifecycle (Danel, 2016).

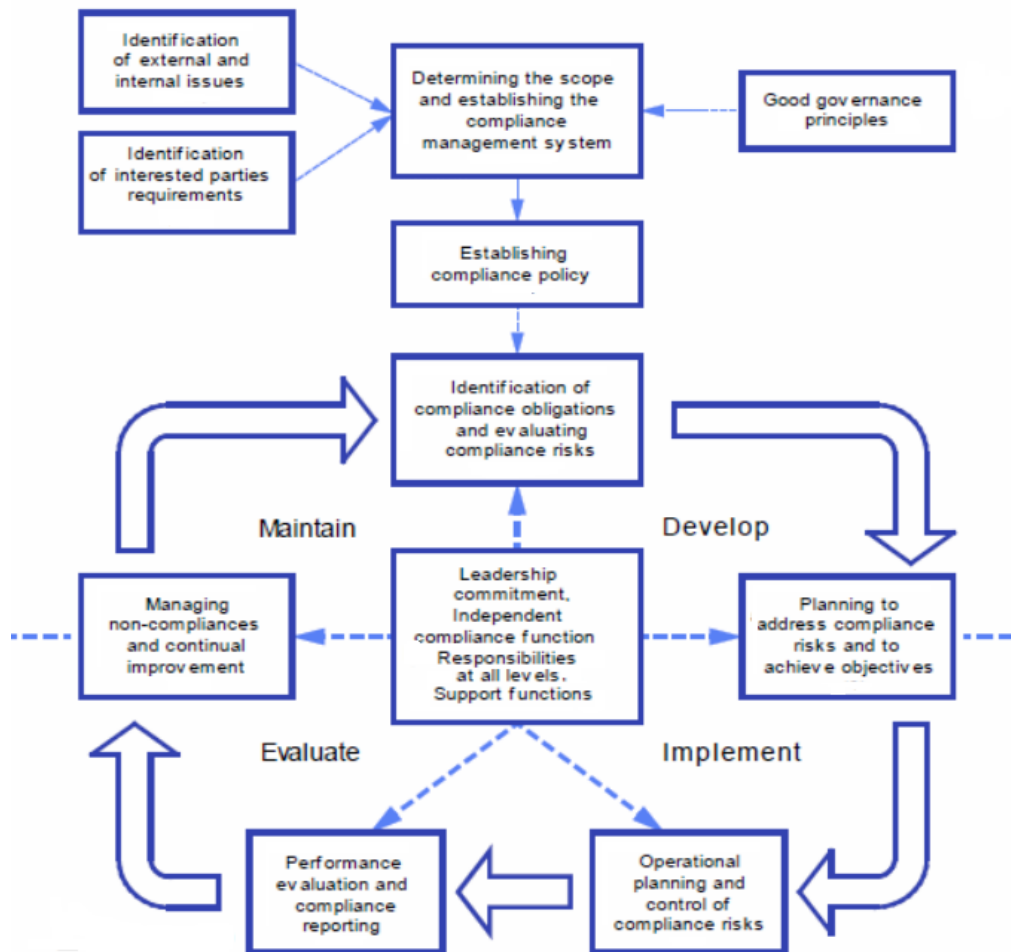
1. Methods of Compliance Management System development

Internal financial reporting is designed to prevent and minimize employee error or fraud (Stone, 2009). The basic principles of this authorization concept are:

1. *sequential separation* (two signatures principle) that represents the division of work activities so that one employee does not perform critical activities that would allow fraudulent behavior (for example the user should not have the rights to create vendors and to enter new orders into the system);

2. *individual separation* (four eyes principle) that is based on controlling work activities and workers themselves. This principle is used in cases where certain activities cannot be separated and must be performed by one person . The principle then uses the tools as supervisor control and approval, monitoring critical indicators or metrics, or monitoring user activity (Maasen et al., 2007);
3. *spatial separation* (separate action in separate locations);
4. *factorial separation* (several factors contribute to completion).

Fig. 1: Visualization of Compliance Management System



Source: (ISO 19600, 2014)

When applying this approach, it is also necessary to think about the structure of the organization itself, which should divide the job positions into sub-circuits and define the field of activities of individual financial reporting staff at the outset already in beginning (Pitner & Ministr, 2015). In practice, we can meet three divisions (sometimes named as towers):

5. *Purchase to Pay* (PTP) includes supplier-related activities;
6. *Record to Report* (RTR) includes activities over the main ledger;
7. *Order to Cash* (OTC) includes customer-related activities.

1.1 Segregation of Duties Matrix (SoD)

Segregation of Duties Matrix forms the basic key element for implementing the authorization concept SoD declares collision activities of person that pose a risk in case if the same person can perform these activities. All risks should be described in detail, and the impact of these risks on the organization should also be determined (Moravec et al, 2017). The complex SoD matrix usable for enhancing the security of the information system is made up of four layers based on the general authorization concept of this system (Vilamova et al. 2016). The SoD matrix is therefore divided into four layers:

1. *Function and activity* where is the individual processes defined by the management are evaluated, which are subsequently logically transferred into the information system environment to the level of each activity. At this level, there is an initial assessment and risk assessment of financial reporting. This layer also identifies pairs of activities that constitute a potential risk of corruption or unlawful behavior in the case of one person. An example of such activities may be the creation of suppliers and the placing of new orders in the system.
2. *Transaction code* that forms the transaction. Information systems mostly operate on a transaction basis, which represents individual activities. In this layer, we find ourselves in a situation where two transactions stand against each other, allowing one person to perform inappropriate risk activities. If the user has the authority to these transactions, this is the first signal of possible abuse, and the risks and impacts that this represents for the organization and need to be evaluated.
3. *Authorization object* are the cornerstone of the authorization concept of the majority of information systems. From the SoD point of view, it should be noted that for example, through the authoring object is set up to perform a specific activity such as viewing, deleting, or creating of the data items. Through the object is also defined access to data depending on the transaction. In this layer are deeper explore permissions for individual transactions and collisions which are already based on the combination of transaction. For example, transaction A plus of the given authorization object versus transaction B plus of the given authorization object.
4. *Value of authorization object* provides a comprehensive and in-depth view of the risk situations that may arise in information system. The individual authorization objects are supplemented with data fields and their value. For example, the value of the authorization object determines whether a user can make through the given transaction the changes or deletions of data, or can only look at data, etc. Simply put, it is no longer true what is valid for first layer about conflict transactions. For example, if a user has been set an authorization object with a view-only value for a given conflict transaction, then this is no longer a conflict, because the user can create orders but is no longer able to create a vendor master record. The creation of a complex SOD matrix of collisions in practice, which is declared in the fourth layer and covers all the activities of the organization, is very laborious and difficult.

1.2 Construction of SoD Matrix

Mostly, the SoD matrix is created separately for individual particular areas (towers) of the organization (Beley and Chaplyha, 2017):

1. Purchase to Pay (PTP),
2. Record to Report (RTR),
3. Order to Cash (OTC),
4. and groups, which contains processes related to system administration.

The following steps are used to construct the SoD matrix (see picture 2):

5. on X and Y axes are gradually applied to the individual activities;
6. activities are then divorced into transactions, authorization objects and their values;
7. Finally, the pairs of critical activities are marked.
8. Fig. 2: Example of collision identification in SoD matrix

Fig. 2: Example of collision identification in SoD matrix

Sub-circuit	Function /activity	Create Sales Orders	Change Customer Master Dat (General View)
Order to Cash	Create Sales Orders		
	Change Customer Master Dat (General View)	X	

Source: own

2. Case study of CMS

The Faculty of economics of VSB-Technical University of Ostrava participated on the solution the project of increasing the security of information in terms implementation of CMS in a larger logistic company.

2.1 Organizational structure of development team

The organization established the following four roles with CMS:

1. *Business Process / Data Owners* (BPO) which responsible for the implementation and integrity of organizational process data with respect to the information system;
2. *Compliance Management Person* where are employees who help administrators implement internal business rules, evaluate access risks, and suggest alternative controls due to SoD collisions;
3. *End users* who use their authorization to execute transactions and use other system functionality;
4. *Administrators* of information system which are in charge of following the instructions from BPO and compliance management.

2.2 Requirements of CMS

Based on an analysis of the current status, the framework requirements that should be met within the compliance management innovation are defined:

1. enhanced collision control on authorized objects;
2. the possibility of simple analysis of individual employees;
3. the ability to easily define rules;
4. intuitive operation;
5. the possibility of defining one rule for multiple systems;
6. portability of the application for another system.

3. Results and discussion of CMS Case study

CMS was implemented in the following three stages:

1. *Creating SoD matrix and risk definition* that includes the following actions:
 - a) determination of critical activities in defined areas (OTC, PTP and RTR);
 - b) transaction assignment, authorization object, and data field values;
 - c) determination of collisions;
 - d) risk definition.
2. *Design and fulfil the database:*
 - a) creating a conceptual model using the ER diagram;
 - b) obtaining data from the SoD matrix and the current information system.
3. *Creating a User Environment - Program Applications.*

All of the stages of innovation described above had to be carefully consulted with the individual user role groups defined in the CMS.

In the course of the project, 220 new functions were identified and formalized. which were entered into the database. The database created and updated in this way effectively helps to manage authorization and authentication requirements of user's roles in processes of organization

The results of implementing the CMS innovation project shows that it is possible:

4. to increase the overall level of information security in the organization;
5. to enhance the efficiency of processes that check compliance with the organization's rules and authorization authorizations for the information system users.
6. to reduce of the likelihood, the occurrence damage.

Conclusion

The compliance management system, as part of the organization's information system, is a very important extension of the organization's functionality in area of security and human resources management.

With tools (notably Segregation of Duties Matrix) and automated control procedures, a company can implement ethical, competency, security, and other necessary rules into its information system architecture to automate the emergence and cause of disagreement.

Companies that want to be successful in the long term in competition while taking due account of the expectations and expectations of stakeholders, should maintain a culture of integrity and compliance throughout the organization. Consequently, the compliance management system is one of the cornerstones of organizational prevention against employee fraud.

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Performance Evaluation of Automotive Cluster Member Companies in the Czech Republic and Slovakia

Abstract

The paper evaluates the impact of cluster initiative membership on the financial and innovation performance of member companies in the automotive industry. The aim of this paper is to compare the financial and innovation performance of member companies of selected cluster initiatives in the Czech and Slovak Republics and to verify the assumption that Slovak member companies are more efficient than Czech. The research sample includes member companies of two cluster initiatives operating in the automotive industry – Moravian-Silesian Automotive Cluster and Automotive Cluster Slovakia. The financial and innovation performance of companies is examined through data envelopment analysis (DEA). Evaluation of financial and innovation performance in a single time period will be done by applying a classic BBC-I model. In the first part of the paper, the financial and innovation performance of the member companies of each initiative will be examined separately and then a comparison will be made. The research results show a stronger influence of cluster initiative membership on the financial and innovation performance of member companies in the case of a cluster in Slovakia.

Key Words

cluster initiative, data envelopment analysis, industrial property rights, efficiency, financial performance, innovation performance

JEL Classification: L25, L62, C60

Introduction

Cluster groups build on the networking nature of business. The past two decades have witnessed a great wave of interest in the cluster area by both experts and economic policy makers, and cluster support has become the predominant strategy to promote economic development in majority of foreign countries (Fang, 2015). According to Porter (1998), the cluster is a "geographically close cluster of interrelated companies, specialized suppliers, service providers and affiliated institutions in a particular field that compete, co-operate, share, and complement each other."

In the Czech Republic and other V4 countries, with the exception of the Slovak Republic, there is a relatively developed system of support for the establishment and development of cluster initiatives. The emergence and development of cluster initiatives is supported in the Czech Republic mainly from public sources and from the EU Structural Funds since the Czech Republic's accession to the European Union (hereinafter the EU). Since 2004, clusters have started to be supported under the Industry and Entrepreneurship

Operational Program through the Clusters sub-program, which ran until 2006. The main objective of the program was to support clustering and cluster development projects at regional and supra-regional levels. Under this program, a total of 53 cluster initiatives were awarded grants and preferential loans. In 2007, this program was followed up by the sub-program called Cooperation-Clusters which ran until 2013 under the Operational Program Enterprise and Innovation for Competitiveness. In this period, support was provided to 39 cluster inquiries totaling CZK 1,073,606,967 (MPO, 2010). Since 2014, the clusters have been supported by the Operational Program Enterprise and Innovation for Competitiveness, which runs until 2020 (CzechInvest, 2018).

A large number of cluster initiatives have been established in the Czech Republic and many public funds have been invested in their creation and development. In 2002, the first cluster initiative established in the Czech Republic was a National Engineering Cluster. As of January 1, 2019, there were about 100 cluster initiatives in various industries.

In developed countries, including the Czech Republic, cluster policy is an important part of development policies. In the Slovak Republic, however, system support for the emergence or development of clusters, unlike in the Czech Republic, is missing. In the conditions of Slovakia, the need to implement a comprehensive supportive approach to cluster development emerges more and more significantly and also the need to exploit the potential of clusters for the benefit of Slovakia's development (SIEA, 2019a).

In 2007, the Slovak Innovation and Energy Agency began to participate in creating suitable conditions for the development of cluster initiatives, in the preparation and provision of their support and evaluation. Its aim is to emphasize the need to introduce systemic support for clusters in Slovakia (SIEA, 2019a).

The Ministry of Economy of the Slovak Republic started subsidizing the first form of support in 2013 through subsidies for industrial clusters. The support is focused on the implementation of non-investment projects containing one or more of the following activities: education organized by industrial clusters or training of industrial cluster members, presentation of industrial clusters and their members in Slovakia and abroad, creation of a common expert base, technological maps of industrial clusters and strategy of industrial clusters and the participation of industrial clusters in international projects and networks (SIEA, 2019b).

The Ministry of Economy of the Slovak Republic has decided to support research and development activities in enterprises and in industrial cluster initiatives with an amount exceeding EUR 360,000. 45 companies and 7 industrial cluster initiatives have received assistance. The Ministry of Economy of the Slovak Republic also plans to allocate financial resources in the amount of EUR 2.8 million for this form of support in the period 2015-2020. In particular, the promotion of industrial cluster initiatives is aimed at strengthening their mutual cooperation in innovation development programs, training and joint expert bases, as well as the stronger involvement of these organizations in international projects and initiatives (SIEA, 2019b).

All contemporary Slovak clusters, as well as the Czech ones, are initiated and organized from the outside, that means they were created from top to bottom. They are also called

constructed clusters. The main initiators and founders are mainly self-governing regions and towns and businesses. The first cluster initiative was established in 2004, it was a Technological Cluster for the Efficient Use of Earth Resources.

However, in comparison with the Czech Republic and other EU countries, Slovakia is significantly lagging behind in the number of cluster initiatives (about 50 as of January 1, 2019) and especially in the efficient functioning of existing clusters (approx. 25). In Slovakia, cluster initiatives operate in two areas - technology and tourism.

Unlike the Czech Republic, it can be stated that Slovak cluster initiatives were created on the basis of the needs of companies in their sector and not because of the possibility of obtaining state or other public support (Slovak Business Agency, 2014).

The aim of this article is to find out whether there is a difference between the performance of cluster member companies in the Czech Republic and Slovakia. Two clusters from the automotive industry were selected for this purpose, one of which is based in the Czech Republic and the other in Slovakia. The method of data envelopment analysis is used as a tool for measuring financial and innovation performance.

1. Theoretical basis

Data Envelopment Analysis (hereinafter referred to as DEA) is a technique suitable for evaluating the technical efficiency of production units (DMUs) of different types. It is a non-parametric method based on mathematical programming that was first presented in 1978. The DEA method is currently applied in many sectors such as education, health, finance, public services and transport (Charnes et al., 1994).

DEA helps decision makers to classify DMUs into two categories: efficient DMU and inefficient DMU. DMU efficiency is defined as the ratio of the weighted sum of outputs (i.e. power) to the weighted sum of inputs (i.e., the resources used). If one input (e.g., employee number) and one output (e.g. profit) is used to evaluate efficiency, the efficiency of the DMU being monitored can be calculated using formula (1).

$$Efficiency = \frac{Output}{Input} \quad (1)$$

The result of the application of DEA models is the so-called efficiency score. If this score equals one, DMU is efficient; if the score is less than one, the DMU is inefficient. In this article, a production unit is meant to be a business entity.

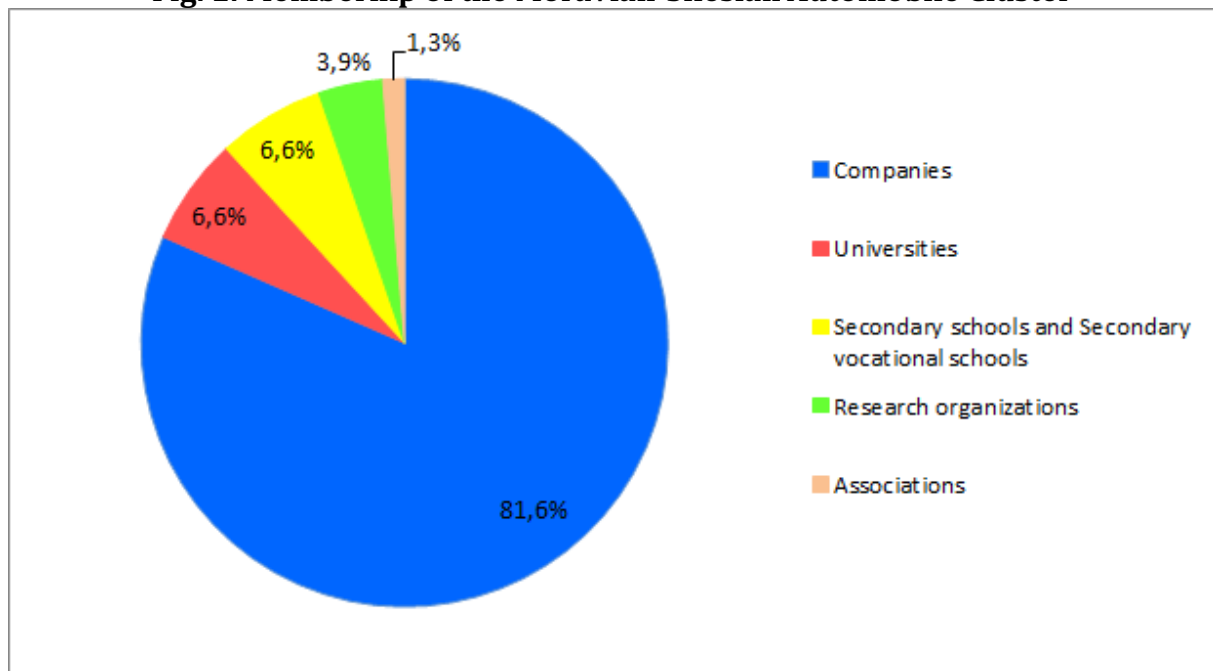
Depending on the production capabilities and properties of the input and output variables, two basic groups of DEA models can be considered: the model by Charnes, Cooper and Rhodes (CCR) and the model by Banker, Charnes and Cooper (BCC). The CCR model differs from the BCC model in that the BCC model considers constant returns to scale while the BCC model considers variable returns to scale (Charnes et al., 1978).

2. Data and Methodology

The research was carried out in 2016. The selected period was chosen because most of the companies did not yet publish their financial results in the Commercial Register after this period. The research can be divided into the following steps:

1. Definition of cluster initiative in the Czech Republic and Slovakia. The **Moravian-Silesian Automotive Cluster**, which was established in 2006, was chosen for the Czech Republic's conditions. It seeks to build a common corporate identity in the cluster and wants to build trust and positive attitudes towards the automotive industry and the region. The cluster is based in Ostrava and has the legal form of a registered association (autoklastr.cz, 2014). In the analyzed period, the cluster had 76 members and was also the largest Czech cluster initiative. Apart from 62 companies, three research organizations, one association, five universities and five secondary schools are members of the cluster (see Figure 1).

Fig. 1: Membership of the Moravian-Silesian Automobile Cluster

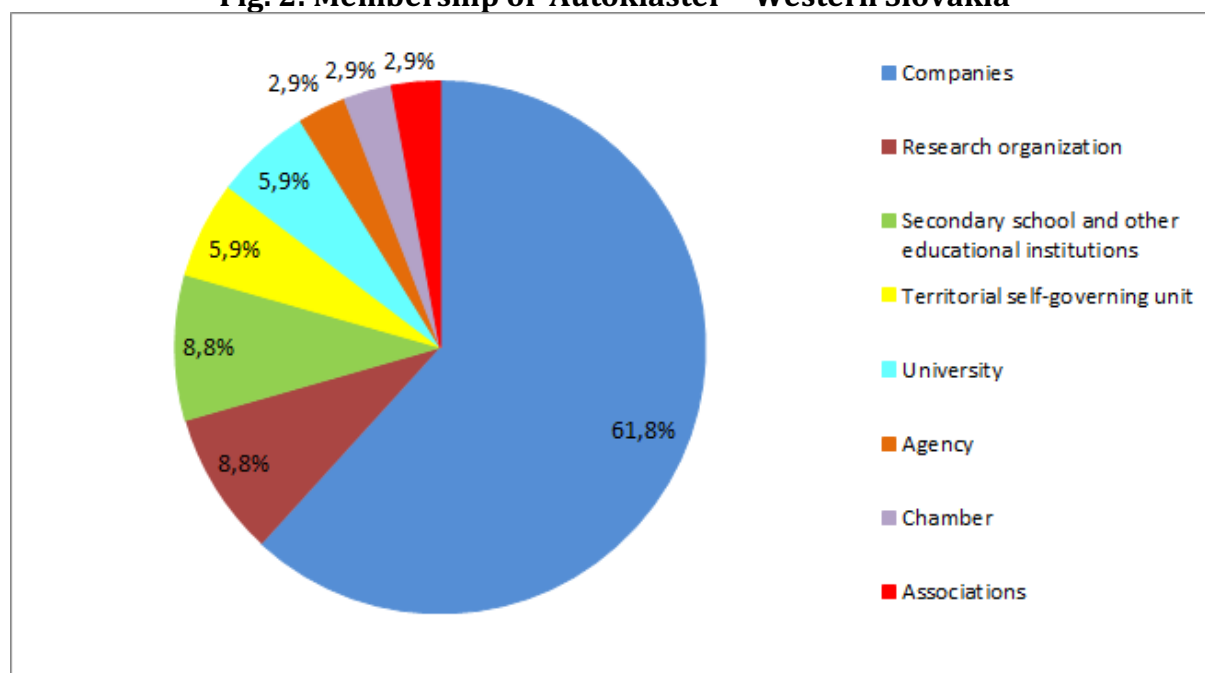


Source: authors' own processing

Autocluster – West Slovakia, which was established in 2007, was chosen for the conditions of the Slovak Republic. The mission of the cluster is to build a prestigious and modern base for the automotive industry in Western Slovakia, to assist the development of subcontractors to the automotive industry and to help ensure their continued competitiveness at home and abroad with the help of partnerships of industrial enterprises, universities, scientific research institutions and other private and public sector entities. The cluster is based in Trnava and has the legal form of an interest association of legal entities (Autoklastr, 2019). In the analyzed period, the cluster had 34 members. It is the second largest Slovak cluster initiative. Apart from 21 companies, the cluster also includes three research organizations, one agency, two universities, two secondary schools, one educational institution, one chamber, the city of Trnava, the

Trnava Self-governing Region and the Union of Engineering Industry of the Slovak Republic (see Figure 2).

Fig. 2: Membership of Autoklaster – Western Slovakia



Source: authors' own processing

The comparison of the membership of the two cluster initiatives shows that the Slovak cluster initiative has a smaller number of business entities than the Czech ones. Furthermore, it is also important to emphasize that territorial self-governing units are also members of the Slovak cluster initiative, which is not very frequent in the conditions of Czech cluster initiatives.

Both selected clusters received benchmarking analysis organized by the European Secretariat for Cluster Analysis within the European Cluster Excellence Initiative Bronze Label Certificate. It is a valuation of the cluster in terms of its quality of management and the success of its activities. Autoclaster - Western Slovakia received this award in 2013 and the Moravian-Silesian Automobile Cluster in 2017 (Autoklaster, 2019).

2. Creating a list of evaluated companies. The web pages of both selected cluster initiatives were used as the source. Identification numbers of member bodies, including contact information and a link to the member's website, were obtained from this site. The aim of this article is to evaluate financial and innovation performance, therefore only member business entities will be included in the research sample for further research.

3. Obtaining data from financial statements. The MagnusWeb database was used as a data source for the Czech cluster. 2016 data were available in the balance sheet and profit and loss account for 50 out of 62 companies. However, two companies showed negative equity and were therefore excluded from further research. The revised core set represents 48 companies. The Finstat database and the Financial Statements Register were used as a data source in the Slovak cluster. 2016 data were available for all 21

companies. However, one company had negative equity and was therefore excluded from the research. The modified core set represents 20 companies.

4. Obtaining data on number of employees. Data on the number of employees were obtained from the MagnusWeb database in the case of the Czech cluster. If an interval was given, its mean was used for other purposes. If the value for 2016 was not specified, the last available data was used. If the company stated zero number of employees, one employee (person working on their own account) was included. The Finstat database was used as a data source in the Slovak cluster, and because only the interval data on the number of employees were available in 2016, the mean of the interval was used for the next procedure.

5. Obtaining data on the history of member companies. In this case, the history of the company was perceived as a form of accumulated intellectual capital, including the know-how, skills and experience of employees. The data came from the Public Register and the Collections of Documents in the case of the Czech cluster and from the Finstat database in the case of the Slovak cluster.

6. Obtaining data on the number of patents. Data on the number of industrial rights were obtained from the database of the Industrial Property Office in the case of the Czech cluster. The database of the Industrial Property Office of the Slovak Republic was used as a data source for the Slovak cluster. Data for the Czech cluster initiative were available for all 62 companies. Data for the Slovak cluster initiative were available for all 21 companies.

7. Selection of DEA models and definition of inputs and outputs. For the evaluation of financial and innovation performance, a classical input-oriented DEA model with variable returns to scale was chosen. The number of employees, total assets and equity was selected as inputs for evaluating financial performance. The economic results of the accounting period and revenues from the sale of own products and services were selected as outputs. For the evaluation of innovation performance, the age of the company and the number of employees were chosen as the inputs, the number of industrial rights as outputs (the total number of patents, industrial and utility models and number of trademarks). Since the DEA can only be applied to positive values and the profit for the accounting period has gained both positive and negative values, it was necessary to increase this output by a sufficiently large constant so that all values of this variable were positive.

8. DEA model construction and efficiency score calculation. The performance of member business entities will be evaluated using the BCC-I model. The BCC-I model works with the assumption of variable returns to scale and can be written by (1) under the convexity condition (2). The BCC model provides the so called pure technical efficiency score (PTE).

$$E_0 = \min. \theta - \varepsilon \left(\sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right) \quad (2)$$

$$\begin{aligned}
& \text{s. t. } \sum_{j=1}^n \lambda_j X_{ij} + s_i^- = \theta X_{i0}, i = 1, \dots, m \\
& \sum_{j=1}^n \lambda_j Y_{rj} - s_i^+ = Y_{r0}, r = 1, \dots, s \\
& \sum_{j=1}^n \lambda_j = 1
\end{aligned} \tag{3}$$

$$\lambda_j, s_i^-, s_i^+ \geq 0, j = 1, \dots, n, i = 1, \dots, m, r = 1, \dots, s.$$

θ unrestricted in sign.

In this model, λ_j are weights of all DMUs, s_i^- and s_i^+ are slack variables, $\varepsilon > 0$ is an infinitesimal constant defined to be smaller than any positive real number and θ is the efficiency score that expresses the reduction rate of inputs in order this unit reaches the efficient frontier.

9. Comparison of results for individual research files. In the last step of the research, the differences between the PTE score values for the two research sets were compared using a non-parametric Wilcoxon-Mann-Whitney W test. The authors of the article verified the research hypothesis that companies with membership in the Slovak cluster show higher PTE score values than companies with membership in the Czech cluster. With the Wilcoxon-Mann-Whitney W test, the following hypothesis was always tested among the research groups: Business entities in the Moravian-Silesian Automotive Cluster have significantly different PTE score values than business entities in Autocluster - Western Slovakia. The null hypothesis has always assumed that there was no statistically significant difference between the medians of both research sets. When a statistically significant difference between medians was demonstrated, the difference was again examined with the Wilcoxon-Mann-Whitney W test. STATGRAPHICS Centurion XVII software was used to test the above hypotheses, all statistical tests were performed at a significance level of α 5%.

3. Research results

Table 1 presents selected characteristics of position and variability for the results of the input-oriented BCC model in the evaluation of financial performance in both research groups for 2016. An interesting finding is represented mainly by the median value of score efficiency of members of the Slovak cluster, which indicates that at least half of the members of this cluster have been marked as an efficient unit. Both the median and the average value of the efficiency score in the Slovak cluster are higher than the values for the Czech cluster.

Tab. 4 BCC-I Model Results (Financial Performance)

	Moravian-Silesian Automotive Cluster	Autoklaster – Western Slovakia
No. of entities	48	20
Average	0.7316	0.8946
Median	0.7055	1.0000
Standard deviation	0.2649	0.1711
Minimum	0.0568	0.4871
Maximum	1.0000	1.0000

Source: authors' own processing

Table 2 presents selected characteristics of position and variability for the results of the input-oriented BCC model in the evaluation of innovation performance in both research groups for 2016. Also from the point of view of innovation performance, it is clear that the median and average efficiency scores reach higher values for the Slovak cluster.

Tab. 5 BCC-I model results (innovation performance)

	Moravian-Silesian Automotive Cluster	Autoklaster – Western Slovakia
No. of entities	62	21
Average	0.2278	0.5280
Median	0.0769	0.4061
Standard deviation	0.3165	0.3331
Minimum	0.0345	0.0933
Maximum	1.0000	1.0000

Source: authors' own processing

In order to verify the significance of the differences between the two research groups, a comparison of the Wilcoxon-Mann-Whitney W test was performed. Results at the 5% significance level showed that a statistically significant difference between the medians of the PTE score of both research groups was verified for the year 2016 when evaluating financial performance. The difference was further specified so that the original two-sided alternative hypothesis was reformulated as one-sided. Again, the Wilcoxon-Mann-Whitney W test was performed. The test criterion value W was 661.5 and the P-value test was about 0.01, which led to the rejection of the null hypothesis and, conversely, to the acceptance of a one-sided alternative hypothesis. Thus, for 2016, it was verified that the median value of the PTE score of companies in the core of the Slovak cluster (1.00) was significantly higher than the median PTE score of companies in the core of the Czech cluster (approximately 0.71).

A similar approach has led to similar conclusions in terms of evaluation of innovation performance. Results at the 5% level of significance showed that a statistically significant difference between the medians of the PTE score of both research groups was verified for the year 2016 when evaluating innovation performance. The difference was further specified so that the original two-sided alternative hypothesis was reformulated as one-sided. Again, the Wilcoxon-Mann-Whitney W test was performed. The test criterion W was 1092.5 and the P-value test was about 0.00, which resulted in the rejection of the null hypothesis and, conversely, the acceptance of a one-sided alternative hypothesis. Thus, for 2016, it was verified that the median value of PTE score of companies in the core of the Slovak cluster (approx. 0.41) was significantly higher than the median PTE score of companies in the core of the Czech cluster (approx. 0.08).

Tab. 6 Wilcoxon-Mann-Whitney W test

Type of performance	Value of test criterion Wilcoxon-Mann-Whitney W test (P-Value)
Financial performance	W = 661.5 (0.0054183)
Innovation performance	W = 1092.5 (0.00000185053)

Source: authors' own processing

Conclusion

The submitted paper dealt with the comparison of financial and innovation performance of members of two automotive clusters in the Czech Republic and Slovakia, which are the Moravian-Silesian Automobile Cluster and Autoklaster - West Slovakia.

In the Czech Republic, the creation and development of cluster initiatives within the existing support system is subsidized mainly from public sources and EU structural funds, but similar system support is missing in Slovakia. While there is a hypothetical possibility of establishing clusters for public support (and practice shows that this is indeed the case), this reason is not currently relevant in Slovak conditions. Yet institutionalized clusters exist in Slovakia and their members expect positive benefits from cluster membership.

The authors of the article focused on examining these differences in financial and innovation performance measured by the so-called technical efficiency, or the efficiency of converting selected inputs into outputs. This was done by the DEA method, thanks to which the financial and innovation performance of members of the Czech and Slovak clusters was first evaluated separately. Yet from descriptive statistics in relation to the efficiency score, it could be concluded that Slovak business entities, compared to the Czech ones, are able to transform more efficiently selected inputs into outputs. By applying a statistical test focused on the significance of the differences between the medians of the two sets, it was verified that both the financial and innovation performance of the Slovak cluster showed a significantly higher (i.e. better) rating than the Czech cluster.

Based on the above mentioned study, the validity of the hypotheses that the companies in the Slovak institutionalized cluster achieved better financial and innovation results than the Czech cluster companies was statistically verified on data for 2016. This statement cannot be generalized due to limited time series availability, especially in the case of innovation performance indicators.

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The Impact and Challenges of the Global Economic Crisis for Achieving Competitiveness of the Selected Company

Abstract

A clear understanding of customer's needs is an essential aspect in the pursuit of competitiveness in the companies. Answering the question of which delivers the best product or service becomes harder as the time flows, as all of them are in pursuit of achieving the same goal: truly understand how the market behaves. It is a fact that competitiveness and benchmarking process between automotive companies are challenging in a stable global economic scenario. How would be those processes in a global economic crisis? Which challenges companies must address in order to be competitive in this scenario? This article presents a case study of a global automotive supplier and the challenges it faced during the 2008-09 economic crisis over statistical analysis of its demand and downtimes, where many lessons learned from this scenario could be studied for better prediction and handling of future ones.

Key Words

benchmarking, competitiveness, automotive industry, global financial crisis

JEL Classification: C1, L6

Introduction

The question of which company delivers the best product or service becomes harder as the time flows, as all of them are in pursuit of achieving the same goal: truly understand which the customer's needs are. Due to the evolution of humanity and its faster means of knowledge dissemination through the globe, those demands become more complex to fulfill, as products and services need to be more customizable, adaptable and, at the same time, reliable, robust and with great quality evaluation. These aspects seem to be very subjective when different markets are analyzed but there is certainly one aspect that needs to be taken into consideration to be a competitive product, service and, consequently, company: lowest selling price possible. And taking it deeper into the production or aggregate value chain, the statement becomes a matter of who delivers the lowest cost possible.

In order to compare companies of a same market, the process of benchmarking has been used since its first publication in 1989, where the ones which are rated as market leaders or detain the biggest market share or also considered a reference according to a determined comparison parameter (e.g. Quality control, cost, lead time, reliability,

robustness, service level and others) set a level for the other competitors (Delbridge, 1995 et al). It also provides support for comparison different plants and processes of one company, finding possible gaps and improvement opportunities within the production processes.

Leading the discussion to the automotive industry, competitiveness and benchmarking processes are even more sensible, as its processes and products have a high complexity level and a huge impact on the world economy (Žižka, 2016). It's not only a matter of which company has the lowest production costs, but also a very detailed quality control program (mostly implemented with Total Quality Management), maintenance of production machinery and aftersales, spare parts control, internal and external logistics, administration of supply chain and a very important key aspect: environmental impact (Pelantová, 2018). Clearly, it's not a simple process to determine which automotive brand would be called as a "best-in-class". It's mainly a matter of which parameter(s) is(are) taking into consideration for comparison. Another important aspect to mention is the geographical effect of the market, which is deeply related to the customer profile. Despite the fact that automotive market widens its global effect each year, would be accurate to compare equally how competitive a vehicle is in different markets without understanding customer's car preferences? It would deliver inaccurate information for the company.

All those approaches properly address the fact that competitiveness and benchmarking process between automotive companies is challenging in a stable global economic scenario. How would be those processes in a global economic crisis? Which challenges companies must address in order to be competitive in this scenario?

To understand this question, this paper brings an analysis of which challenges an automotive supplier from European Union (EU) faced during the 2008-2009 global crisis on its maintenance process.

Before focusing on the company's data, it's needed to understand the impacts of the global economic crisis on the automotive industry, presented in the next chapter of this paper.

This paper is divided into five sections: Chapter 1 shows relevant literature research regarding benchmarking and competitiveness. Chapter 2 presents relevant information about the studied company. Chapter 3 brings conclusions and future possible works from this research.

1. Brief literature review: Benchmarking

Since the early 80's the concept and application of the benchmarking process have been studied and published in the literature, including the discussion of Xerox Corporation practices comparing operational costs between plants in USA and Japan (Delbrige et al, 1995). Originally the concept adopted by the Westinghouse Productivity and Quality Care, when Xerox won the Malcolm Baldrige National Quality Award in 1989 correlates the pursuit of better practices to improve competitive performance, quoted as:

"Benchmarking is a continuous search for an application of significantly better practices that lead to superior competitive performance" (Camp, 1989)

Through the 90's and early 2000's, a few publications discussed the concept brought in 1989, bringing guidelines, relationship with practicability, improvement opportunities resulting from the benchmarking process. Dattakumar (2003) presents these perspectives over the concept shown in Table 1.

Table 1: Outcome of earlier literature reviews

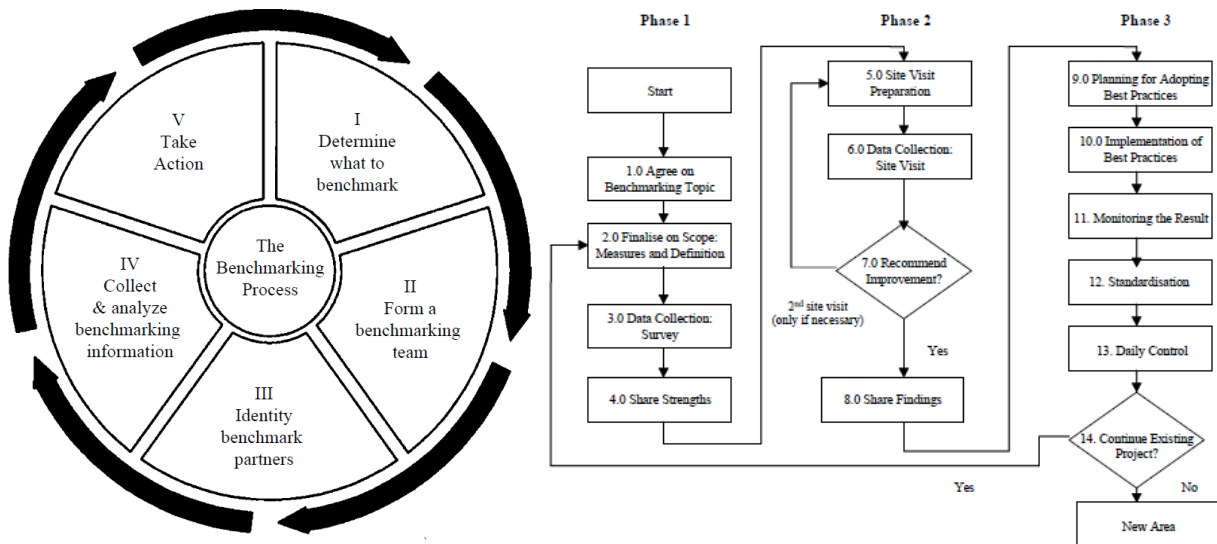
#	Title of Paper	Outcome
1	"Roadmap to current benchmarking literature", by Jackson et al. (1994)	The paper gives a guideline for the classification of literature on benchmarking, based on the types of benchmarking and associated issues and comments on each article in terms of these criteria
2	"Review of key publications on benchmarking: part I and part II", by Zairi and Youssef (1995c, 1996)	The papers spell out in detail about the contents of only books on benchmarking in terms of the practicability and applicability of the resource material. Publications in journals and conferences are omitted in this paper
3	"Benchmarking: a select bibliography", by Vig (1995)	The paper is targeted towards personnel in libraries, to enable them to track author wise classification of articles on benchmarking
4	"A framework for benchmarking in the public-sector literature review and directions for future research", by Dorsch and Yasin (1998)	In the paper, the authors have identified, that the academic community is lagging in terms of providing and advancing models and frameworks that integrate the many facets of organizational benchmarking. The authors also mention that most of the benchmarking know-how available are the results of practitioners' efforts
5	"The theory and practice of benchmarking; then and now", by Yasin (2002)	The paper summarizes that despite the increasing scope of benchmarking activities and the number of organizations utilizing benchmarking, the field of benchmarking remains to a large extent without a unifying theory to guide its advancement. Also, a call is given to developing innovative methodologies to guide benchmarking practices in e-commerce and supply chain management

Source: Adapted from Dattakumar (2003)

Recent publications explore the definition of a framework (Baba 2006 apud Yusof 2000), bringing the need of a set of parameters or aspects delimiting the benchmarking process, i.e., the base data for comparison between companies (e.g. lowest lead-time, highest service level, biggest Mean Time Between Failures (MTBF) and others). Baba (2006) presents some models for generic benchmarking processes (as cited in Spendolini, 1992 and NPC, 1999), where are explained the main steps for their implementation, as shown in Figures 1a and 1b. The first one shows in a PDCA-like cycle the phases and their benefits

of the comparison process. The second one is a flowchart of the main phases of this process.

Figures 1a (left) and 1b (right): Models for the benchmarking process.



Source: Baba (2006) (as cited in Spendolinni

1992 and NPC 1999)

Other authors bring classification and differentiation inside the benchmarking process (Hollesen and Freytag, 2001), giving it a better practical and applicable approach. They divide the whole process into three main definitions:

- Benchmarking as an independent growing process of efficiency, which relies on analysis of performance levels of what is in examination compared to other levels inside the organization and identification of root causes of performances problems to proper guide corporate activities reconfiguration (as cited in Kruteen 1999);
- Benchlearning associated with previously mentioned “best-in-class” company or object in order to absorb those practices in all company, also known as “learn from the best” and
- Benchaction as the work plan for implementation of all changes obtained from benchmarking and benchlearning, and also to improve employees with training and development.

Hollesen and Freytag (2001) also define some types of benchmarking, depending on what the company wants to compare:

- Internal: related to processes and units that have similar functions, identifying the best internal practices and expanding to the other units;
- Industry (also called by the authors as functional): This is an internal or external comparison, which measures the company’s functional operations and then compares to similar measures from other companies, mostly with market leaders or which detains the biggest market share. It’s also not a direct competition, mostly

intended to share information for processes improvements within a market or multinational company;

- Competitive: External comparison used against direct competitors, in order to change the market share between them, pointing failures and advantages of concurrent products and services. Information is harder to be obtained from this process and generally involves high costs and
- Process (also called as generic by the authors): this one compares similar procedures at dissimilar companies and it's very hard to implement, because it needs a very solid and broad understanding of process and procedures, in order to extrapolate to other markets or industries.

They also compare advantages and disadvantages of the benchmarking process within and across industries, shown in Table 2.

Table 2: Advantages and disadvantages of benchmarking within and across industries

Benchmarking within the industry	Benchmarking across industries
Advantages: similarity of the competitive situation eases the transfer of experience	Advantages: inspiration to improve processes, etc. In which areas are the advantages best and/or easy to realize
Drawbacks: the perception of the competitive situation is too narrow which makes it difficult to catch up with other companies as regards competition	Drawbacks: it is difficult to transfer experience across industries. Perhaps eliminate focus from the obvious problems in the company

Source: Adapted from Hollensen and Freytag (2006)

2. Results of the Research

2.1 The Company studied

Due to confidentiality, the name of the company won't be presented in this article. However, for this research, the data analyzed on next subchapters were obtained from a global automotive exterior parts supplier, mostly from its activities in the Czech Republic operations facilities. According to its 2016 annual report, it registered a net revenue of US\$ 2.78 billion, with more than 155,000 employees allocated in 29 countries around the world.

The Czech facility is responsible for production and assembly of front and rear bumpers, energy management systems, polycarbonate modules, spoilers for aerodynamics and many other parts inside a vast product portfolio for the global automotive market.

As the demand of passenger cars has substantially decreased in 2009 and had reached the lowest value in the horizon of the last 10 years, as shown in Figure 2 for the whole European market, many challenges have appeared to its operation: stock management and its increased cost, as predicted demand was expected to be much bigger, new pattern for seasonal demand, increase of machinery non production and many others, bringing the company a big reduction of its net revenue by the end of the year as a reflex of this global crisis and increasing of variable and fixed costs. In the next subchapter is detailed the main focus of the case study.

Figure 2: Comparative demand for passenger cars in European Market.



Source: AIE (2016)

2.2 Research Objectives

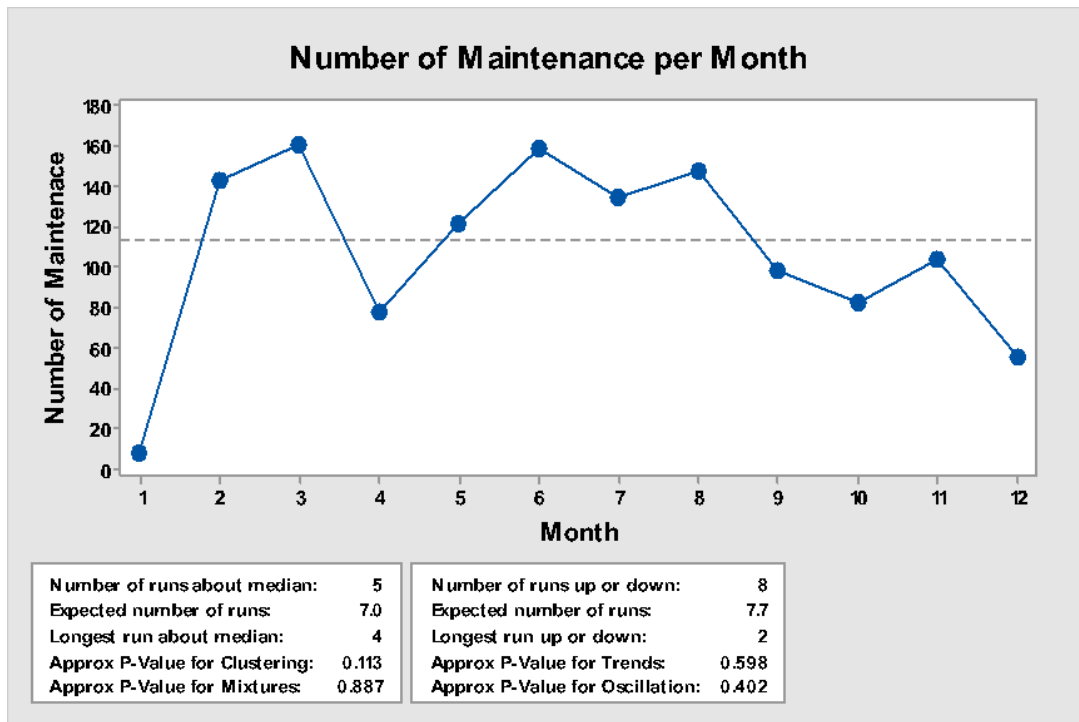
The data analysis conducted by the statistical SW Minitab aims to check the statistical correlations between some parameters in the automotive industry, such as seasonal demand and stoppage time. It is important to highlight that the conclusions presented here are related to the year of 2009, which as said before, was a turbulent period for the world and also the European automotive industry.

2.3 Discussion

In Figure 3 below, it is possible to observe that the number of maintenance, which is strongly related to problems occurred in-line production, probably due to demand. It is clear to observe that maintenance in the beginning and at the end of the year is quite lower than the rest of the year, also it is not varying close to the mean, as the other results. It is important to highlight that the data provided for January starts on the day 26, so many data are probably lost or the production faced a long recession.

Besides the number of maintenance for January and December are not close to the mean, as it can be observed in Figure 4, they are still into the confidence level of 95%. It means that the process is in steady-state – p-value for oscillation is above alpha of 0.05 – and there are no outliers in this production line. So, for this period of time, special causes can be neglected. This fact is justified by the p-value for clustering above alpha value. Also, variation in number of maintenance shows a downward trend from month 6 – p-value for trends of 0.598 – which can be caused by implementation of a better production control of equipment or decrease in production.

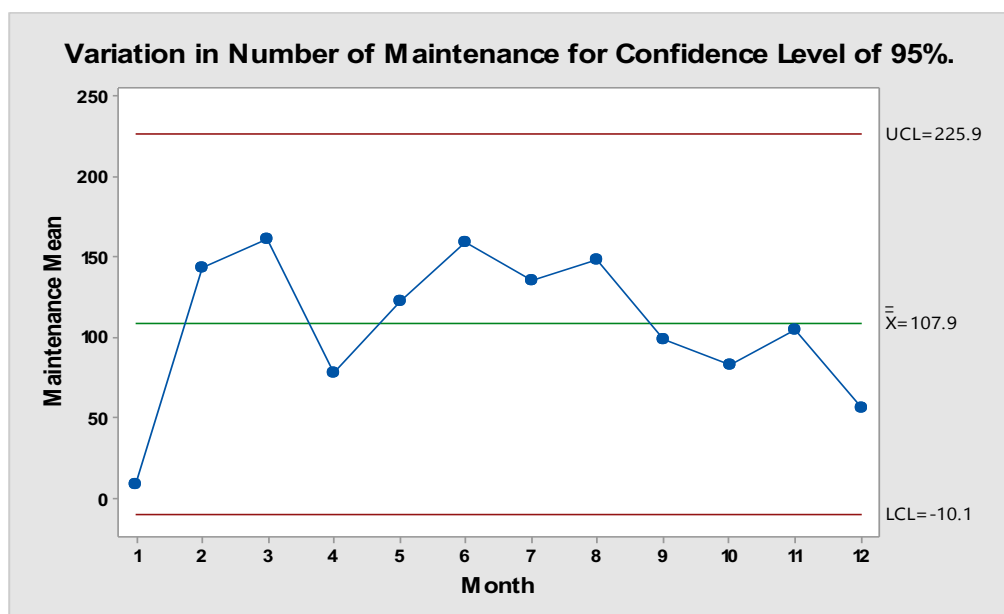
Figure 3: Number of maintenances per month in 2009.



Source: Authors own adaption.

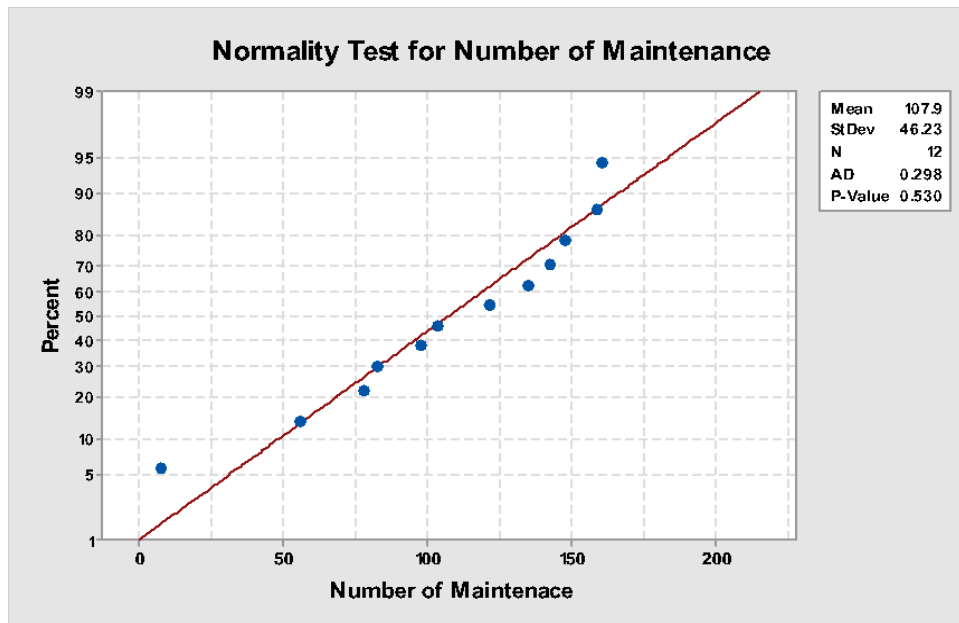
In order to complete the evaluation of these data, a normalization test was conducted and the results are shown in Figure 5. As the data are not far from the fitted distribution line (red line) and the p-value is higher the alpha value, the null hypothesis, which the data do not follow a normal behavior, can be neglected by lack of information to prove it. However, it's not possible to affirm that it presents a normal behavior.

Figure 4: Variation in number of maintenance for a confidence level of 95% in 2009.



Source: Authors own adaption

Figure 5: Normality test for number of maintenance in 2009.

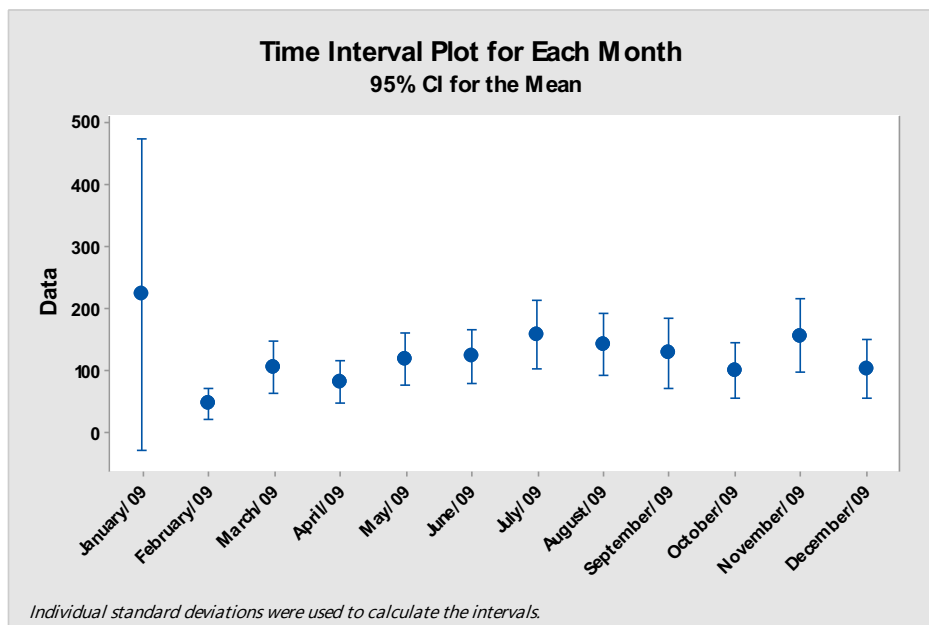


Source: Authors own adaption

It is also important to analyze the duration of each maintenance since it affects the profits and probably the whole production chain. Figure 6 shows the variation in time for each month. In January, the variation occurs due to the lack of date, which means that the data will not converge to the mean value, as the other results.

In relation to months from February to December, the duration of maintenance time varies approximately to a mean. When the January data are excluded, it is possible to note that the variation in maintenance time is approximately of 100 minutes.

Figure 6: Interval plot for maintenance time for each month in 2009.



Source: Authors own adaption

Conclusions and final statements

This article intended to discuss and present challenges faced by companies from the automotive sector during the 2008-2009 global crisis, focusing on the European Market. Going deeply over the article's structure. Chapter 1 explores relevant concepts on the benchmarking process, presenting ongoing and past models and explanation of its fundamentals. Chapter 2 presents the main contribution of this article, discussing the effects of the crisis in a global automotive supplier company in Europe, presenting some statistical analysis over seasonal demand and stoppage time.

After a brief introduction and a literature review of relevant concepts and topics of benchmarking, it is clear that achieving competitiveness is a constant need for major multinational companies, especially in a crisis scenario, where available resources are at its lower level, costs at higher, demand as minimum as ever and many operational problems came ahead to make this process even harder.

What is important to sustain is that all lessons learned that came from intermittency and seasonal effect of demand in a crisis environment are even more sensitive than a regular economic scenario and serve as a base for improvement of demand forecast and prediction patterns for the future. Who knows when will be the next economic crisis? It's not 100% guaranteed to predict, but it is definitely needed to be ready for when it comes again.

Many future works and research from this article are possible, as individual aspects of maintenance, size of stocks, demand forecast and many others can be discussed from the data collected for this article, as a consequence of how relevant is to understand the effects of a global economic crisis in all perspectives in companies and its impact and challenges for achieving competitiveness.

Acknowledgment

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Readiness of Czech Regions for Industry 4.0

Abstract

The aim of this paper is to create and apply a methodology for evaluating the readiness of the Czech NUTS3 regions for Industry 4.0 and, in conclusion, to evaluate their mutual position in the readiness for global challenges that Czech industry will face in the near future. The phenomenon of the 4th Industrial Revolution, sometimes also called Industry 4.0, or else, the digital economy, represents a complex of large-scale quantitative but, in particular, qualitative shifts, stimulated by the processes of digitization, automation, robotic automation and virtual reality (augmented reality) towards which the developed market economies are heading in the following two decades. The key issue is how well the Czech economy will be prepared at both national and regional levels, until the 4th Industrial Revolution breaks out. The introduction part presents previously published composite indexes, which evaluate individual national economies. Both their structure and results are described in the article. The proposed regional composite index RPI 4.0 includes five areas that are essential to the successful adaptation of the Czech environment to the phenomenon of the 4th Industrial Revolution. In particular, this concerns the areas of human resources and labour market, science and research, education, technical infrastructure and business innovation. The evaluation is based on sub-indexes calculated for each region for the area. A total of 21 indicators from the time period 2011-2017, which are available at NUTS3 level, enter the calculations.

Key Words

Industry 4.0, Digital Economy, information society, NUTS3 regions, composite index.

JEL Classification: O33, R11

Introduction

The aim of this paper is to create and apply a methodology for assessing the readiness of Czech regions (NUTS3) for Industry 4.0, and finally to evaluate the mutual position of Czech regions in the readiness for global challenges that Czech industry will face in the near future. The paper builds on and extends previous publications of Sojková (2017) focused on social dimension, labour market and education in the context of Industry 4.0, Nedomlelová and Werner (2017) focused on situation analysis of Ústí nad Labem Region and Kocourek and Nedomlelová (2017) focused on relationship between level of education and economic growth. They all were created within the framework of an internal research project Regional Development of the Czech Republic in the Context of the Onset of the Fourth Industrial Revolution.

The phenomenon of the 4th Industrial Revolution, sometimes also called Industry 4.0, or else, the digital economy, represents a complex of large-scale quantitative but, in particular, qualitative shifts, stimulated by the processes of digitization, automation,

robotic automation and virtual reality (augmented reality) towards which the developed market economies are heading in the following two decades. This is a manifestation of natural technological development that the Czech Republic is unlikely to avoid. The key issue is how well the Czech economy will be prepared at both national and regional levels, until the 4th Industrial Revolution breaks out.

Industry 4.0 fundamentally changes the nature of the entire secondary economic sector, as well as energy, trade, logistics and other parts of the economy and society as a whole (Wolter et al., 2015). In the context of the 4th Industrial Revolution, massive production can be expected without the participation of unskilled labour, the interconnection of intelligent devices, production lines and products, production systems, warehouses, logistics and service into one intelligent information network, where smart devices of customers, manufacturers and suppliers will be to help one another and to communicate in real time to the needs of customers without human help (Mařík et al., 2016).

In particular, international institutions are concerned with assessing readiness for the challenges of the 4th Industrial Revolution at national level. For the EU countries, the so-called Digital Economy and Society Index (Foley et al., 2018) is published every year. The DESI composite index includes 5 pillars based on sub-indicators available mainly in EUROSTAT datasets, which are as follows:

1. Connectivity (fixed, mobile, fast, ultrafast Broadband and Prices).
2. Human Capital (Basic Skills and Internet Use, Advanced skills and Development).
3. Use of Internet Services (Citizens' use of Content, Communication and Online Transactions).
4. Integration of Digital Technology (Business Digitization and e-commerce).
5. Digital Public Services (eGovernment and eHealth).

Currently, the Czech Republic ranks 17th out of the 28 EU Member States. The Nordic countries of Denmark, Sweden and Finland are traditionally the most digitally advanced, whereas Bulgaria, Romania and Greece rank at the bottom of the list. In fact, the gap between the Czech Republic and the least developed digital economies is much smaller (11-14 percentage points) than the difference between digital leaders and the Czech Republic (about 18-20 percentage points). The value of the DESI index for the Czech Republic is below the 28 EU Member States average, by almost 1.7 percentage points. We are lagging behind the EU average mainly in the area of Internet services use, low level of eGovernment, as well as human capital.

The Global Information Technology Report 2016, published by the World Economic Forum (Baller et al., 2016), is also a regular source of information society assessment, where 139 countries are assessed by means of the composite Networked Readiness Index (NRI). The index consists of 4 sub-indexes that include 10 pillars. Sub-indicators are more reliant on opinion polls (26 out of 53 indicators); a composite index as well, however this index has a relatively high perceptual component. The following rated areas are as follows:

1. Political and regulatory environment (9 indicators).
2. Business and innovation environment (9 indicators).
3. Infrastructure (4 indicators).

4. Affordability (3 indicators).
5. Skills (4 indicators).
6. Individual usage (7 indicators).
7. Business usage (6 indicators).
8. Government usage (3 indicators).
9. Economic impacts (4 indicators).
10. Social impacts (4 indicators).

Tab. 1: Pillars and indicators of DII 4.0 Readiness Index 2016

Pillars	Weights in %	Indicators	Weights in %
Basic Enablers	19	Electricity infrastructure	1
		Educational maturity	3
		Educational supply	10
		Proficiency of financial market	2
		Corporate training and education	3
Driving forces	6	Wage level	2
		Government vision for ICT usage	2
		Competition	2
Industry 4.0 specific enablers	19	Knowledge-intensive employment	2
		Educational excellence of math and science programmes	5
		Market access to the newest technologies	2
		Excellence of scientific research institutions	1
		Fostering of talent	5
		Access to scientists and engineers	1
		Readiness to devolve decision-making and responsibilities	3
Demand factors	2	Sophistication of demand	2
Technological sophistication	27	Usage of general technology	15
		Usage of information and communication specific technology	2
		Level of medium and high-tech manufacturing activities	10
Enterprise excellence	22	Sophistication of competitive advantage	10
		Breadth of value chain operations	2
		Complexity of production processes	10
Innovation aptitude	5	Innovative capacity	5

Source: authors' own processing according FAARUP and FAARUP (2016)

The Czech Republic ranks 36th among 139 countries. The Nordic countries of Finland, Sweden and Norway are among the most digitally advanced, however Singapore is in the lead. We are lagging behind the average in this assessment mainly in the perceptually assessed areas related to the political and regulatory framework, e-Government, but also, for example, the excellence of mathematics education.

The Danish Institute of Industry 4.0 is also involved in measuring and assessing the readiness of countries specifically for industry 4.0. The Global Industry 4.0 Readiness Report 2016 includes outlooks up to year 2021, where 120 countries are assessed and the applied composite DII 4.0 Readiness Index is based on 7 pillars (see Tab. 1). Within the 28 EU Member States, the evaluation results rank the Czech Republic among the unprepared

countries together with other 7 countries acceding to the EU in 2004. Manufacturing is very important to the unprepared countries (via Value added in % of GDP), however, these countries are unprepared for the Industry 4.0, and they will most likely not be able to sustain their status quo. Leaders with high value added in industry and high readiness include Finland, Sweden, Germany, but also Ireland and Austria. The study finds Singapore to be a leader in the readiness for Industry 4.0, followed by Ireland, Switzerland and Japan. The Czech Republic is on the 27th place out of 120 countries, according to the authors it should drop two places by 2021. The results show that we are falling behind primarily in the area of Demand factors (88th place), Driving forces (47th place), on the contrary, we achieve encouraging results in the area of Technological sophistication (17th place).

1. Methods of Research

Based on the research conducted in the previous section and the research for indicators and their accessibility at the territorial level of NUTS3, the Regional Industry 4.0 Readiness Index for the Czech Republic (RPI 4.0) was created (see Tab. 2 for more).

The composite index consists of areas that partially cover the pillars and indicators of the composite index according to Faarup and Faarup (2016). The labour market is mainly focused on the regional position in the level of wages paid to ICT and industry workers (basic enablers / driving forces), the science and research area focuses on the regional position in employment of science and research workers in ICT and industry (Industry 4.0 specific enablers).

The level of technical infrastructure is assessed primarily by indicators of LTE coverage, household access to high-speed internet and the quality of the electrical distribution network (basic enablers). Innovation aptitude area is covered by the level of technical and process innovations (CZSO, 2018). Last but not least, the area of education was assessed, primarily from the point of view of university students and graduates in the fields of ICT and technology (Industry 4.0 specific enablers).

Each area has been added certain value, which, according to the authors, is relevant and consistent with the scientific publication Faarup and Faarup (2016), which states the values of the individual indicators. The relative share of areas within the comitology index, i.e. driving forces (12%), Industry 4.0 specific enablers (45%), basic enablers (27%) and innovation aptitude (15%) is more or less kept. Areas that are understood to be determined at national level and between regions without distinction are not deliberately included in the index. It concerns for example political and regulatory environment. The sources of data for the calculation were mainly the regional statistics of the Czech Statistical Office 2012 - 2018 and the selective statistical survey of Innovation Activities of Enterprises 2014 - 2016. (CZSO, 2019) (CZSO, 2018)

Tab. 2: Pillars and indicators of Regional Industry 4.0 Readiness Index for the Czech Republic (RPI 4.0)

Pillars	Weights in %	Indicators	Weights in %
Labour Market	25	The share of average regional gross monthly wage in the ICT segment on the national average	35
		The share of average regional gross monthly wage in industry segment on the national average	25
		The share of regional employment in ICT segment in total ICT employment in the Czech Republic in relation to the share of regional employment in total employment in the Czech Republic (rate of regional specialization)	25
		The share of regional employment in industry segment in total industry employment in the Czech Republic in relation to the share of regional employment in total employment in the Czech Republic (rate of regional specialization)	15
Research & Development	25	The share of employees in ICT segment (R&D) in all employees within the region / all employees in ICT segment (R&D) in relation to all employees in the national economy of the Czech Republic	30
		The share of employees in industry (R&D) in all employees within the region / all employees in industry segment (R&D) in relation to all employees in the national economy of the Czech Republic	20
		The share of employees in R&D segment (Research and Development) within enterprises in all employees in the region / all employees in enterprise R&D in relation to all employees in the national economy of the Czech Republic	20
		The total share of R&D employees in all employees within the region / all employees in enterprise R&D in relation to all employees in the national economy of the Czech Republic	30
Technical infrastructure	15	Coverage of LTE networks	15
		LTE population coverage	10
		Household access to VRI	10
		Quality of distribution energy network SAIFI	15
		Quality of distribution energy network SAIDI	15
		Quality of distribution energy network CAIDI	15
		Fast broadband coverage (at least 30 Mbps)	20
Innovation Performance	15	Enterprises with process and product-process engineering innovation	40
		Intensity of technical innovation (share of technical innovation costs in total revenues of enterprises with technical innovation)	60
Education	20	The share of university students in ICT segment in all students within the region / all students in the ICT segment in relation to all university students in the Czech Republic	20
		The share of university students in the fields of technology and construction industry in all students within the region / all students in the fields of technology and construction industry in relation to all university students in the Czech Republic	20
		The share of university graduates in ICT segment in all graduates within the region / all graduates in ICT segment to all graduates in the Czech Republic	30

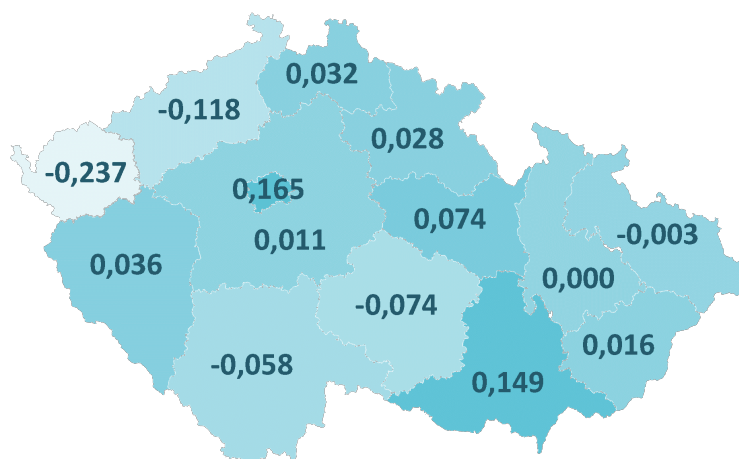
		The share of university graduates in the fields of technology and construction industry in all graduates within the region / all graduates in the fields of technology and construction industry ICT segment to all graduates in the Czech Republic	30

Source: authors' own processing based on CZSO (2019), ERO (2019)

2. Results of the Research

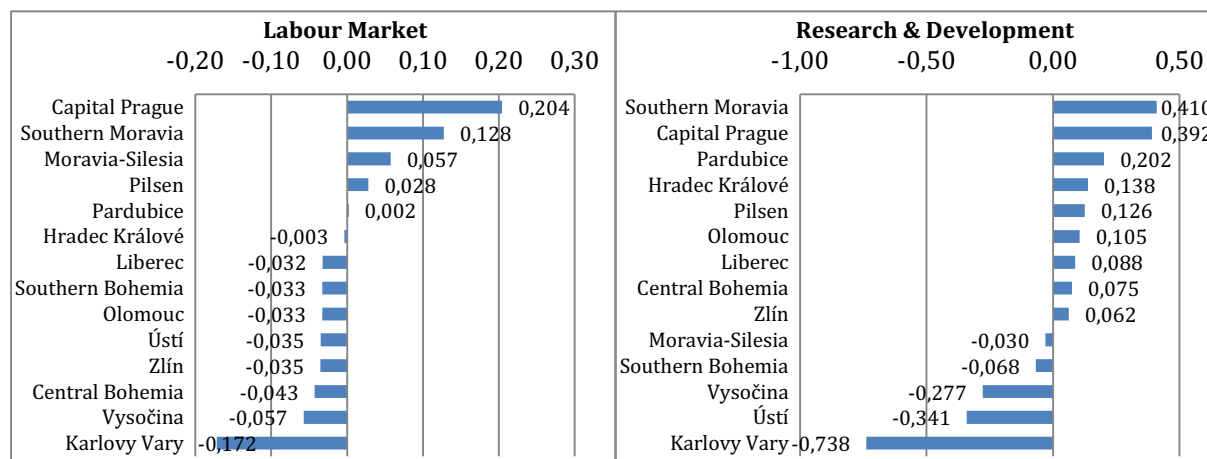
The composite index was calculated with regard to the informative value of regional disparities. Deviations from the national average are therefore represented by plus or minus values from zero as the national average. The overall results of the Regional Industry 4.0 Readiness Index for the Czech Republic (RPI 4.0) are shown in the cartogram (see Fig. 1). Decomposition to sub-index level and its results are shown in Fig. 2.

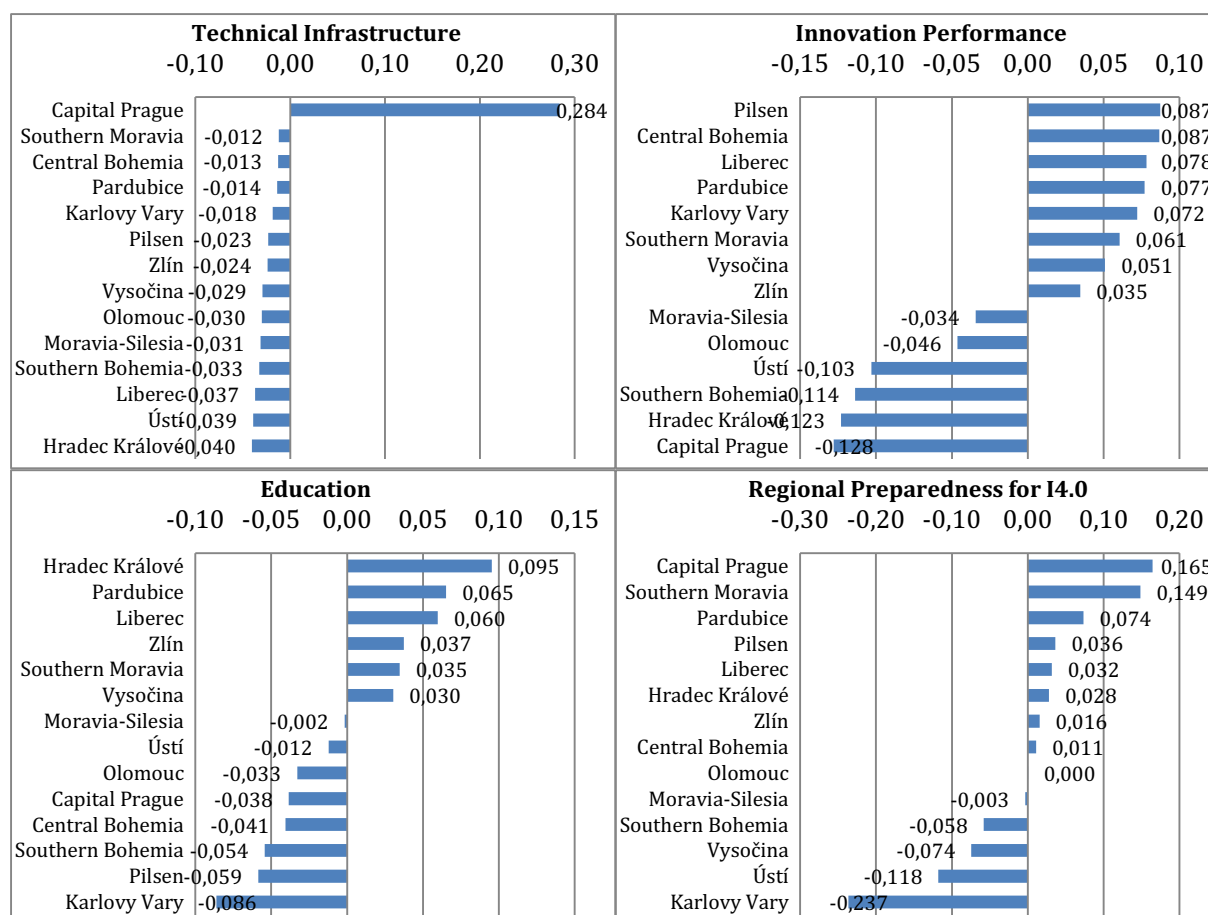
Fig. 1: Results of the Regional Industry 4.0 Readiness Index for the Czech Republic (RPI 4.0)



Source: authors' own calculations based on CZSO (2019), ERO (2019)

Fig. 2: Results of the Regional Industry 4.0 Readiness Index for the Czech Republic (RPI 4.0) in sub-areas





Source: authors' own calculations based on CZSO (2019), ERO (2019)

3. Discussion

According to the resulting index values, the capital city Prague together with Southern Moravia Region rank among the regions that are most prepared to face the challenges of Industry 4.0, where Prague strongly dominates in the area of technical infrastructure and the labour market, while in the area of Research & Development it slightly falls behind the Southern Moravian Region. The results in the area of Education may be somewhat unexpected as Prague appears to be below average, but this is due to the relatively low representation of pure ICT, technical and industrial disciplines among university students and graduates. In the area of Innovation Performance, which in the context of Industry 4.0 includes only technical and product-process innovation, Prague even ranks last, which is most likely due to the generally low number of purely industrial companies. Most innovative solutions are obviously heading for the service segment.

In all areas, except technical infrastructure, Pardubice, which occupies the third place in the region's readiness for Industry 4.0, is above average. Similarly, Pilsen ranks the fourth, however the Education area was evaluated as below-average. Liberec, ranking the fifth with the exception of Technical Infrastructure, records a slightly below-average value in the area of Labour Market. On the other hand, Karlovy Vary and Usti nad Labem keep the opposite end of ranking with all monitored indicators being below average, most in the area of Research & Development. Moreover, Karlovy Vary ranks the worst in the area of

Education due to the absence of a technical university, as well as the area of Labour Market. Olomouc represents the net average in terms of readiness for Industry 4.0.

Conclusion

Several studies are concerned with assessing the readiness of states for Industry 4.0. Most of them rank the Czech Republic in 40th place worldwide. However, in comparison with the EU countries, the Czech Republic, together with other acceding countries, is still rated as unprepared for the challenges of Industry 4.0, although the share of gross value added in the secondary sector (manufacturing and industry) ranks among the highest. The secondary sector in the Czech Republic employs more than two fifths of economically active persons, which makes the second highest share in Europe.

Obviously, the socio-economic impacts of the 4th Industrial Revolution will mainly stem from the ability of regional economic actors to adapt to the new, digital economy, to effectively innovate and to invest in research and development in the field of complex automated solutions. These trends are supposed to be adequately addressed by national and regional authorities in terms of economic policy measures. Due to the dynamics of the development of modern technologies, they must also be prepared to analyse and evaluate socio-economic processes, to find answers to new questions and to address possible negative consequences of the 4th Industrial Revolution. (Kraftová et al., 2018). This paper responds to the absence of assessment of Czech regions' readiness for industry 4.0., even though the differences in the readiness of individual regions for Industry 4.0, especially in the area of R&D and human resources, as well as technical infrastructure and innovation, can play an important role in their further development tendency. The research focused mainly on areas that are quantifiable and where open data sources exist, thus methodological procedures can be repeated over time. Qualitative factors, which are more difficult to measure but should be significant not only in regional but above all international comparisons, are not taken into account here. One of this example can be shown in measuring innovations in relation to economic development (Petříček, 2015). According to Sojková (2017) great deficiencies are also evident in the field of education, where it is necessary to significantly reinforce digital skills. In the context of the onset of the fourth industrial revolution, it is possible to expect a steep rise in the significance of the impact of education (especially of the secondary and tertiary level) on the performance of the national economy. The decisive factor in the process seems to be not only the length of education but also its quality. (Kocourek and Nedomlelová, 2018)

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Usability of cloud computing: a comparison study between IT companies in the Czech Republic and the USA

Abstract

Cloud computing is currently a rapidly emerging, worldwide platform. It creates a new layer on top of the current hardware and software that enables companies to accelerate existing processes, effectively use resources or create brand new products. Therefore, it is necessary to know the current situation and also the technological development in this sector. The Czech Republic and the USA are two distinct geographic, demographic, social and cultural markets, but in the context of globalization are those differences less and less significant. The aim of this comparison study is to find out what is the difference in the usability of cloud computing in companies of both countries and their specifics. This article analyses and discusses users' opinions on the usability of cloud computing in business. Respondents were employees in companies in the Czech Republic and the USA. The research method is survey divided into a demographic and analytic part. The demographic part operates with company location, size, respondent position within the company and preferred cloud service. More data are gained with the use of the SUS (System Usability Scale). Descriptive statistic methods (mean, 95% confidence interval and standard deviation) are applied for better interpretation of the results. The outcome of this study (overall SUS score) is compared to other studies.

Key Words

cloud computing, comparison study, system usability scale, Czech Republic, USA

JEL Classification: M15, O14, N70

Introduction

Cloud computing has become one of the most mentioned information technology concepts in the last two decades. Without a doubt, it influences the lives of people and businesses around the world. Cloud computing allows organizations and consumers to use remote computing resources (performance, storage, ...) or even whole applications under favourable price conditions over the Internet, and by paying for the actually consumed resources. (Armbrust et al., 2009)

The whole cloud computing sector is still developing and offers constantly new features, possibilities, but also risks. Among current trends in cloud computing can be included big data, internet of things or mobile cloud computing. (Martinovsky, 2017; Stergiou, Psannis, Kim, & Gupta, 2018)

This article is focused on the usability of cloud computing: a comparison study between companies in the Czech Republic and the USA. Both countries are two distinct geographic, demographic, social and cultural markets, but in the context of globalization are those differences less and less significant. The aim of the comparison is to find out what is the difference in the usability of cloud computing in business.

The research was held from March 1 to March 31, 2019.

1. Methods of Research

An online questionnaire divided into two parts has been used to obtain answers to the research question: is there a difference in the perceived usability of cloud computing between the Czech Republic and the USA?

The first part included four questions about the respondent and the company he/she worked for:

1. What is the location of your company? (the USA or the Czech Republic)
2. What is your position within the company? (developer, analyst, web designer, DevOps, marketing specialist, project manager)
3. What is the size of your company? (1-9, 10-49, 50-249, 250+)
4. Which cloud service do you prefer? (Rackspace Cloud, IBM Cloud, Amazon Web Services, Microsoft Azure, Google Cloud, other)

There were only two closed answers to the first question: the USA and the Czech Republic. Respondents positions within the company were selected in piloting according to consultations with experts; respondents could write their answer as well since this question was semi-opened. The criteria of the company size are based on the EU definition (European Union, 2015). The fourth question is aimed at participants preferred cloud provider. Answers to the last semi-opened question were preselected by the best cloud computing service in 2019 article on Techradar.com. (Drake & Turner, 2019)

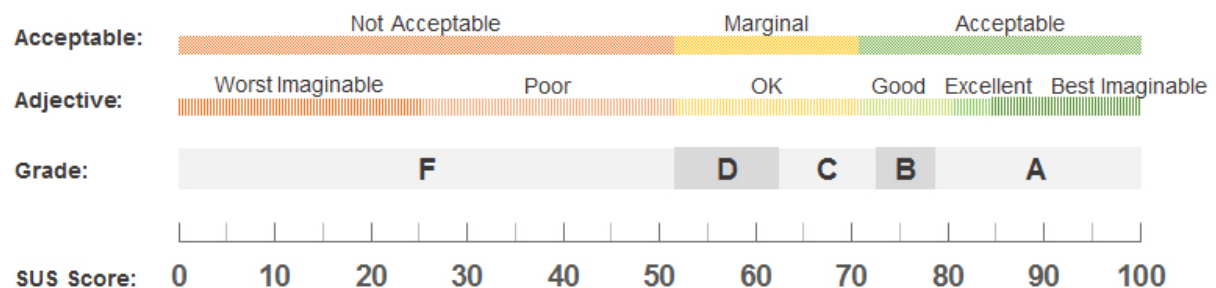
The System Usability Scale (SUS) has been used as a base template for the second part of the questionnaire. According to Lewis & Sauro (2009), SUS is a highly reliable tool used to gather subjective feedback on overall usability and user satisfaction. The questionnaire was based on the SUS and consisted of 10 items, each with 5-point Likert scale response options from 1 (Strongly disagree) to 5 (Strongly agree).

Even-numbered items (1, 3, 5, 7 and 9) are positively worded, and odd-numbered items (2, 4, 6, 8, 10) are negatively worded. According to the SUS guidelines, it is necessary to subtract 1 from the result of all even-numbered items and subtract all odd-numbered items from number 5. The individual result for each SUS item is therefore in the range from 0 to 4, and the total result is in the scale 0 to 40. To get the overall SUS score, it is necessary to multiply the total result by 2.5. The SUS score has a range of 0-100 points (this is an absolute value, not a percentage). (Brooke, 1996)

It has been demonstrated, that the SUS is effective in discriminating good and bad usability features even with very small (12-15) sample sizes. (Tullis & Stetson, 2004)

The average SUS score (the 50th percentile) is 68. That means a raw SUS above 68 is above average and below 68 is below average. Another way how to describe the SUS score is to look at the results as “acceptable” or “not acceptable”. Bangor, Kortum, & Miller (2008) assigned these terms for when the SUS score was well above average or well below average. Acceptable corresponds to roughly above 70 and unacceptable to below 50. They designated the range between 50-70 as “marginally acceptable”. Fig. 1 illustrates other ways how to interpret the SUS score.

Fig. 1: Categories associated with raw SUS scores



Source: Sauro (2018)

As mentioned before, the original System Usability Scale developed by Brooke (1996) was used as a basis for the research questionnaire. This original was slightly modified for the purpose of this research. Tab. 1 shows the list of SUS items included in the second part of the questionnaire.

Tab. 1: SUS questionnaire items

#	SUS item
1.	I think that I would like to use the cloud frequently.
2.	I found the cloud unnecessarily complex
3.	I thought the cloud was easy to use.
4.	I think that I would need the support of a technical person to be able to use the cloud.
5.	I found the various functions in the cloud were well integrated.
6.	I thought there was too much inconsistency in the cloud.
7.	I would imagine that most people would learn to use the cloud very quickly.
8.	I found the cloud very difficult to use.
9.	I felt very confident using the cloud.
10.	I needed to learn a lot of things before I could get going with the cloud.

Source: authors' questionnaire based on Brooke (1996)

Basic descriptive statistics like mean, 95% confidence interval and standard deviation are applied to the raw results to get a better understanding of the nature of the results.

2. Results of the Research

A total of 55 respondents completed the questionnaire; none was excluded from the analysis (all of them have been filled out correctly). Majority of participants was from the Czech Republic (64 %), the rest was from the United States.

In the Czech Republic, data was gained from respondents at a special cloud event, which was held in Pilsen. This event was called “Cloud Solutions”, and its purpose was to improve skills and experience with this platform. The respondents from the USA were contacted by e-mail. All of the participants work in companies where is the cloud used frequently, and those companies are from the IT sector. Questionnaires were collected from 1 to 31 March 2019. Tab. 2 shows information about respondents: where they work, the number of company employees, their specialization and preferred cloud service.

Tab. 2: The characteristic of respondents

Characteristic	Czech Republic (n=35) N (%)	USA (n=20) N (%)	Total (n=55) N (%)
Number of employees			
1-9	3 (8.57 %)	4 (20 %)	7 (12.73 %)
10-49	11 (31.43 %)	7 (35 %)	18 (32.73 %)
50-249	11 (31.43 %)	1 (5 %)	12 (21.82 %)
250+	10 (28.57 %)	8 (40 %)	18 (32.73 %)
Specialisation			
Developer	21 (60 %)	3 (15 %)	24 (43.64 %)
Analyst	1 (2.86 %)	7 (35 %)	8 (15.55 %)
Web Designer	1 (2.86 %)	1 (5 %)	2 (3.64 %)
DevOps	4 (11.4 %)	0 (0 %)	4 (7.27 %)
Marketing specialist	1 (2.86 %)	4 (20 %)	5 (9.09 %)
Project Manager	2 (5.71 %)	2 (10 %)	4 (7.27 %)
Others	5 (14.29 %)	3 (15 %)	8 (15.55 %)
Preferred cloud service			
Amazon Web Services	16 (45.71 %)	6 (30 %)	22 (40.00 %)
Digital Ocean	1 (2.86 %)	0 (0 %)	1 (1.81 %)
Google Cloud	10 (28.57 %)	12 (60 %)	22 (40.00 %)
Microsoft Azure	7 (20 %)	2 (10 %)	9 (16.36 %)
Own	1 (2.86 %)	0 (0 %)	1 (1.81 %)

Source: authors' calculations

In terms of a number of employees, most companies can be considered as small (33 %) and large (33 %). Most of the participants (44 %) describe themselves as developers; the second most represented group is an analyst (16 %). Other respondents filled their own specialization – accounting, business development, IT student, quality assurance, sales director and vision director.

Slightly surprising results were in the question about the preferred cloud service. The question was semi-opened with five preselected cloud services according to the “Best cloud computing service” article (Drake & Turner, 2019). Only 3 of the preselected answers were selected by participants (Amazon Web Services, Google Cloud, Microsoft Azure). One participant answered Digital Ocean cloud service, and one answered that they prefer own (custom) cloud service. No one prefers Rackspace Cloud or IBM cloud.

Tab. 3 shows the results for all items from the SUS part of the questionnaire.

Tab. 3: Results of the SUS

#	SUS item	Czech Republic (n=35)			USA (n=20)			Total (n=55)		
		Mean	95% CI	SD	Mean	95% CI	SD	Mean	95% CI	SD
1.	I think that I would like to use the cloud frequently.	4.00	3.69-4.31	0.91	3.95	3.56-4.34	0.83	3.98	3.75-4.22	0.87
2.	I found the cloud unnecessarily complex	3.03	2.70-3.36	0.95	2.75	2.30-3.20	0.97	2.93	2.67-3.19	0.96
3.	I thought the cloud was easy to use.	3.51	3.18-3.85	0.98	3.65	3.24-4.06	0.88	3.56	3.31-3.82	0.94
4.	I think that I would need the support of a technical person to be able to use the cloud.	2.77	2.37-3.17	1.17	3.40	2.96-3.84	0.94	3.00	2.70-3.30	1.12
5.	I found the various functions in the cloud were well integrated.	3.63	3.36-3.89	0.77	3.80	3.44-4.16	0.77	3.69	3.48-3.90	0.77
6.	I thought there was too much inconsistency in the cloud.	2.69	2.30-3.07	1.13	2.75	2.25-3.25	1.07	2.71	2.41-3.01	1.10
7.	I would imagine that most people would learn to use the cloud very quickly.	3.29	2.95-3.62	0.99	3.35	2.89-3.81	0.99	3.31	3.04-3.57	0.98
8.	I found the cloud very difficult to use.	2.43	2.16-2.70	0.78	2.85	2.30-3.40	1.18	2.58	2.32-2.84	0.96
9.	I felt very confident using the cloud.	3.37	3.08-3.66	0.84	3.70	3.22-4.18	1.03	3.49	3.24-3.74	0.92
10.	I needed to learn a lot of things before I could get going with the cloud.	3.29	2.95-3.62	0.99	3.15	2.62-3.68	1.14	3.24	2.96-3.52	1.04

Source: authors' calculations

SUS: System Usability Scale; CI: confidence interval; SD: standard deviation.

Items 2, 4, 6, 8, and 10 are negatively worded. Lower Means for these items represent higher perceived satisfaction.

The first item has the highest individual SUS score (3.98), which is a good sign for the future of cloud computing – people want to use it more frequently.

Participants perceive that they don't need to learn a lot of things before they can use cloud computing. The last SUS item got the highest score amongst negatively worded items, which means that respondents often didn't agree with the sentence.

Major difference between both countries can be observed at item #4. Participants from the USA feel that they would need technical support more (3.40) than respondents from the Czech Republic (2.77).

Another interesting fact is that responses to the positive statements are more consistent than to the negative ones.

The mean SUS score, as well as 95% confidence interval and standard deviation, were calculated for all participants grouped by their country (the Czech Republic and the USA) and for both countries together, as shown in Tab. 4.

Tab. 4: Overall SUS score

Country	n	Mean	95% CI	SD	Median	Min	Max
Czech Republic	35	59.00	54.63-63.37	12.74	60.00	32.50	85.00
USA	20	58.88	53.16-64.59	12.21	60.00	30.00	87.50
Total	55	58.95	55.59-62.32	12.43	60.00	30.00	87.50

Source: authors' calculations

The mean for overall SUS score across both countries was 58.95, which can be considered as below average. A slightly different interpretation of this result offers Bangor et al. (2008): SUS score between 50 and 70 is perceived as “marginally acceptable”.

Standard deviation (SD) of the SUS score combined for both countries (12.43) is comparable with results of metanalysis based on 959 individual surveys. (Bangor, Kortum, & Miller, 2009)

According to the results of this study, it hasn't been proved that there is any significant difference between both countries in the question of using cloud computing.

3. Discussion

As was mentioned before, this research was aimed (and therefore limited) at respondents within the IT sector (developers, DevOps, analysts, ...). In this context is slightly surprising that these respondents ranked usability of the cloud computing with such a low score because it is expected that these respondents are very familiar with the technology and probably use it on a daily basis.

The overall SUS score is low in comparison with usability scores for other systems. It is behind mean scores for the usability of the web (68.2 %), TV (67.8 %) or cell phones (65.9 %). (Bangor et al., 2009) One of the possible reasons for this can be a bigger complexity of cloud computing in comparison to other systems mentioned above.

Another limitation was the number of participants. However, the SUS method is reliable even for very small sample size. According to Sauro (2013), the mean SUS score is surprisingly stable even for 5 respondents. Of course, confidence intervals will be rather broad with this small sample size, but it gets narrower with the increasing number of participants.

Conclusion

This article is focused on the usability of cloud computing: a comparison study between companies from the IT sector in the Czech Republic and the USA. The aim is to find out what is the difference in the usability of cloud computing in business.

Conducted research showed that the perceived usability of cloud computing is “below average”, “marginally acceptable” or, in the form of a school grade, “D” (OK, but not good).

It also showed that respondents' views from both countries are not very different. That can be caused by an extremely global environment in the IT sector.

For future research, it could be useful to repeat this research with the different target group (non-professionals) and compare the results.

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Analysis of the Financial Indicators in the Enterprises Affected by Industry 4.0

Abstract

Industry 4.0 is a designation for the current trend of digitization, automation of production and related market changes. The businesses must therefore be prepared both in technology and financial terms as well. However, the introduction of Industry 4.0 in enterprises can increase financial requirements or increase financial instability. In this paper, 17 financial indicators are obtained from the balance sheet of 617 analyzed enterprises, for which both quantitative and qualitative research has been carried out. Data was collected for the year 2017. As it is clear from the analysis, the introduction of Industry 4.0 was reflected mainly in total assets (and intangible fixed assets), short-term receivables, equity and total liabilities (and long-term and short-term bank loans and short-term liabilities). Most of these indicators have higher value for businesses that are affected by Industry 4.0 than those that do not yet incorporate automation and robotics. Only short-term bank loans show lower values. This is due to the fact that enterprises affected by Industry 4.0 invest primarily in fixed assets (as it was confirmed) and these assets are financed by long-term resources. On the other hand, a statistically significant difference was not reflected, for example, in long-term receivables, short-term financial assets, basic capital or reserve funds and other funds created from profit.

Key Words

Automatization, Digitalization, Financial Data, Industry 4.0, Robotization

JEL Classification: M41, O33

Introduction

In many developed countries, there were begun a fourth stage of industrialization that is called Industry 4.0 (Zhou, Liu, & Zhou, 2015; Schuh, Potente, Wesch-Potente, Weber, & Prote, 2014). As well as the previous 3 Industrial Revolutions (1st Industrial Revolution - Steam, 2nd Industrial Revolution - Electricity, 3rd Industrial Revolution - IT Technology), the 4th Industrial Revolution is characterized by robotized and automated systems based on future-oriented smart technologies (Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014), (Obitko & Jirkovsky, 2015). In Industry 4.0, all processes are optimized and streamlined (Schuh, Potente, Wesch-Potente, Weber, & Prote, 2014). However, the rapid changes that come with Industry 4.0 are among the important factors that affect financial data, financial indicators and the company's financial position. The primary objective of financial analysis is to analyze the financial situation. In this respect, past statistical data and comparisons are used.

Researchers and companies have different views on the concept and vision of Industry 4.0. However, there is one consensus on the main aspects of the production vision, namely Smart Factory, Smart Products, Business Models and Customers (Pereira & Romero, 2017). The smart concept means products that are intelligent. Thus, decision-making processes there use artificial intelligence control (Molina,Ponce, Ramirez, & Sanchez-Ante, 2014).

Digitization is based on convergence of the physical and virtual world and will have a wide impact on all economic sectors. This is considered to be the driving force behind innovations that will play a crucial role in productivity and competitiveness (Pereira & Romero, 2017).

Industry 4.0 will lead to potential changes in several areas beyond the industry. Botha (2018) says that its impacts can be divided into six main areas - industry, business models, economy, products and services, working environment and skills development. Thanks to Industry 4.0, the company's economic situation and competitiveness should improve over the years and resource efficiency should be improved. According to Rüßmann et al. (2015) it was found that this fourth wave of technological progress will bring benefits in terms of productivity, income growth, employment and investment.

In Industry 4.0 influenced businesses, it is necessary to consider whether it is appropriate to implement robotics and automation. It is possible that businesses that are not prepared for this change will not be able to know their financial possibilities enough and they could get into financial troubles. It is therefore essential that businesses have good financial knowledge and they are able to analyze and correctly assess their financial situation (Hatammimi & Krisnawati, 2018). Financial analysis serves as a tool for financial management. It quantifies the impacts of management decision-making on business performance, evaluates financial trends, and provides the basis for future development management. The aim of the financial analysis is to assess the financial health of the company and identify the strengths and weaknesses of management.

Many authors in the past (Wruck, 1990; Altman, & Loris, 1978; Dichev, 1998) also point to the importance of the company's capital structure in predicting the probability of financial uncertainty. Thus, financial data is the primary source for the decision making and the business evaluation. An essential part of the company management is the financial analysis, which provides feedback between the expected effect of the management decisions and reality. The comprehensive information will help us to evaluate how a business is successful.

The article primarily deals with the evaluation of financial data for enterprises that are affected by Industry 4.0 and who are not affected by Industry 4.0 (so far they are not interested in implementing modern automation and robotics systems, including other advanced technologies). For these enterprises, it is examined whether the selected financial indicators of the companies (in total 17 financial indicators of assets and liabilities) differ significantly in the individual groups.

1. Methods of Research

The non-parametric Mann-Whitney U test was used for statistical analysis. Non-parametric tests are used to compare statistical data sets that cannot be expected to have normal probability distributions. It can be stated that the random variable has an unknown distribution.

This test is used to evaluate unpaired attempts where we compare 2 different selection files. The hypothesis that two quantities have the same probability distribution is tested. In doing so, these quantities do not have to correspond to the Gaussian normal distribution; it is sufficient to assume that they are continuous. The test involves the calculation of a statistic, usually called U, whose distribution under the null hypothesis is known. U is then given by:

$$U_1 = R_1 - \frac{n_1(n_1+1)}{2} \quad (1)$$

where n_1 is the sample size for sample 1, and R_1 is the sum of the ranks in sample 1.

An equally valid formula for U is:

$$U_2 = R_2 - \frac{n_2(n_2+1)}{2} \quad (2)$$

The smaller value of U_1 and U_2 is the one used when consulting significance tables. The sum of the two values is given by:

$$U_1 + U_2 = R_1 - \frac{n_1(n_1+1)}{2} + R_2 - \frac{n_2(n_2+1)}{2} \quad (3)$$

Knowing that $R_1 + R_2 = \frac{N(N+1)}{2}$ and $N = n_1 + n_2$, and doing some algebra, we find that the sum is $U_1 + U_2 = n_1 n_2$.

2. Results of the Research

The aim of this paper is to evaluate the relationship between financial indicators and developments in Industry 4.0. In the research, a total of 617 enterprises were analyzed, the data being obtained on the basis of both quantitative and qualitative research, ie both the questionnaire survey and the supplementary acquisition of data from the Albertina Gold Edition database at enterprises that participated in the questionnaire. The analyzed enterprises were limited by the amount of assets in the range of CZK 5 to 300 million. In the statistical analysis, 17 indicators from the balance sheets of individual companies for 2017 were evaluated. The analyzed enterprises were divided into two categories - the category of enterprises affected by Industry 4.0 and the categories of enterprises not affected by Industry 4.0.

Tab. 1: Mann-Whitney U test – financial data and Industry 4.0

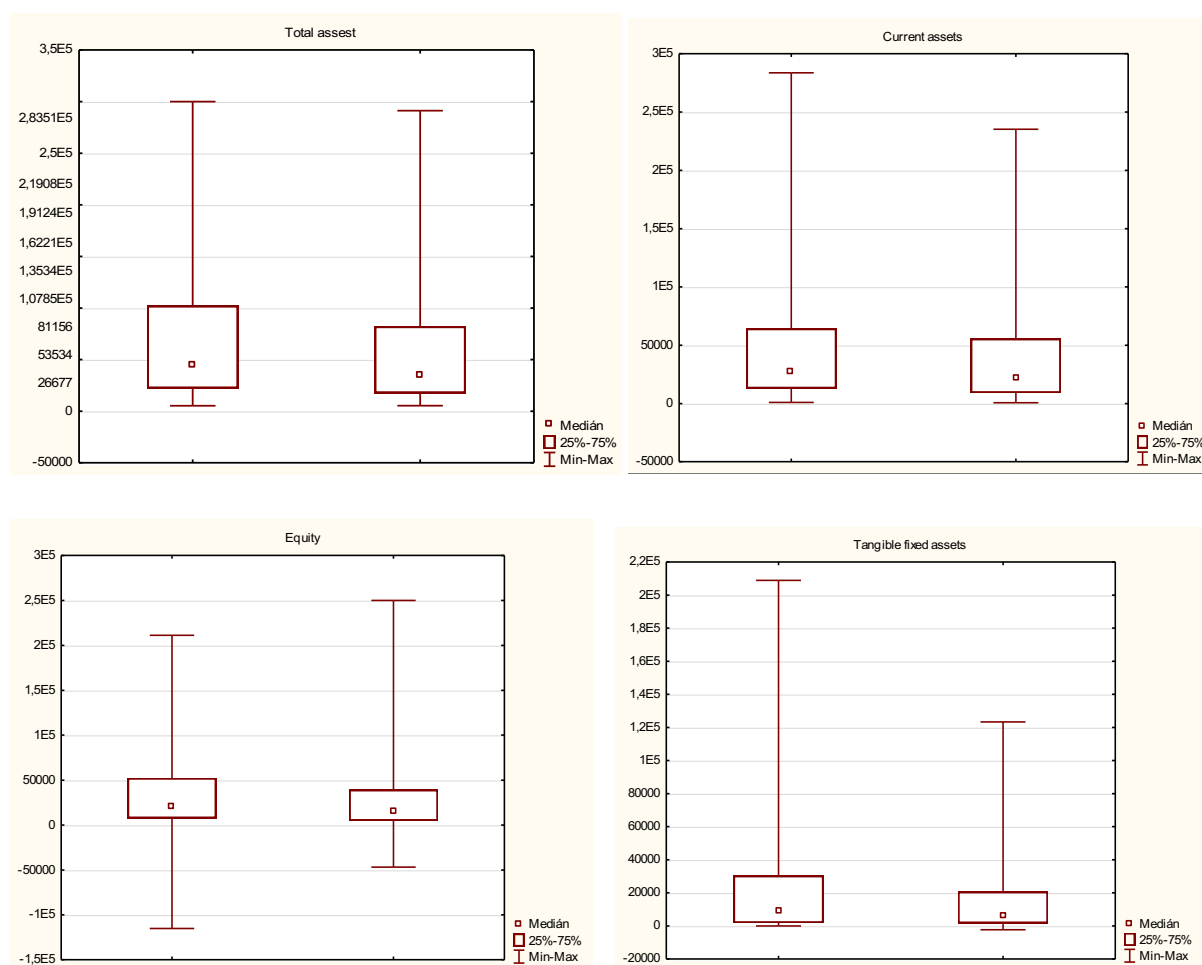
Variable	Yes	No	U	Z	p-value	Num. of NO	Num. of YES
Total assets	125483.0	65170.00	39292.00	2.328767	0.019872	390	227
Intangible fixed assets	128539.5	62113.50	36235.50	3.760214	0.000170	390	227
Tangible fixed assets	124540.5	66112.50	40234.50	1.887366	0.059112	390	227
Long-term financial assets	122080.5	68572.50	42694.50	0.735277	0.462172	390	227
Current assets	125822.5	64830.50	38952.50	2.487764	0.012855	390	227
Inventories	128371.5	62281.50	36403.50	3.681535	0.000232	390	227
Long-term receivables	120030.5	70622.50	43785.50	-0.22433	0.822501	390	227
Short-term receivables	126415.0	64238.00	38360.00	2.765249	0.005688	390	227
Short-term financial assets	122319.5	68333.50	42455.50	0.847207	0.396880	390	227
Equity	125261.0	65392.00	39514.00	2.224797	0.026096	390	227
Basic capital	121439.0	69214.00	43336.00	0.434844	0.663676	390	227
Reserve funds and other funds from profit	119397.5	71255.50	43152.50	-0.52078	0.602519	390	227
Total liabilities	125808.0	64845.00	38967.00	2.480973	0.013103	390	227
Long-term liabilities	124139.0	66514.00	40636.00	1.699332	0.089258	390	227
Long-term bank loans	127978.0	62675.00	36797.00	3.497248	0.000470	390	227
Short-term bank loans	126381.5	64271.50	38393.50	2.749560	0.005968	390	227
Short-term liabilities	125917.5	64735.50	38857.50	2.532255	0.011334	390	227

Source: own research, authors' processing

Within the statistical analysis, the relationship between the financial indicators of the enterprises and the relationship to Industry 4.0 was investigated using a two-sample Mann-Whitney U test at the chosen significance level $\alpha = 0.05$. The hypotheses $H_0 = x_{0,50} - y_{0,50} = 0$ were tested, where it is assumed that the influence of these enterprises by Industry 4.0 is at the same level in both groups and the hypothesis $H_A = x_{0,50} > y_{0,50}$, which assumes that the enterprises not affected by Industry 4.0 will have different values of selected financial indicators. In both hypotheses, X represents the enterprises that Industry 4.0 affects and Y represents the enterprises that Industry 4.0 does not affect. The results of the analysis are summarized in the Tab. 1. As shown in Tab. 1, at a significance

level of 0.05, a null hypothesis was rejected in favor of an alternative based on a p-value of very near zero and a positive Z for total assets, intangible fixed assets, current assets, inventories, short-term receivables, equity, total liabilities, long-term bank loans, short-term bank loans and short-term liabilities. Therefore, we can say that companies affected by Industry 4.0 have different values in these indicators. For all indicators other than short-term bank loans, values of the financial data are higher for businesses affected by Industry 4.0. The graphical representation in the form of selected box diagrams (see fig. 1) also visually confirms this statement. In each figure, the median for the businesses affected by Industry 4.0 is on the left and for businesses not affected by Industry 4.0 are shown on the right. All the figures show a vertical shift of the median higher in the enterprises affected by Industry 4.0. There is also visually seen the median shift on the lower right graph, but this indicator did not appear to be statistically significant.

Fig. 1: Selected financial indicator and Industry 4.0



Source: own research, authors' processing

3. Discussion

Many authors are generally concerned with Industry 4.0, but no research has been found to address the link to the financial indicators. Most studies discuss technical aspects, but no longer pay attention to the financial data and the financial indicators. The

implementation of the Industry 4.0 concept requires constant innovation, which depends not only on financial indicators but it depends on many different factors (Mohelska & Sokolova, 2018).

In short, Industry 4.0 has enormous potential and its implementation will affect the entire production process, improve service and product quality, optimize customer-organization relationships, bring new business opportunities and economic benefits.

The results of this research show that the companies that introduce Industry 4.0 elements are rather the enterprises with a higher value of total liabilities. Surprisingly, a statistically significant difference in the fixed assets was seen in the area of intangible fixed assets and not in the area of tangible fixed assets. However, the value of p-value for the tangible fixed assets is very close to the significance level of 0.05.

In the area of current assets, there were statistically significant differences in inventories and short-term receivables. On the other hand, long-term receivables and short-term financial assets did not show significant differences. It follows that these are probably manufacturing companies. Furthermore, it was found that neither the amount of basic capital nor the amount of reserve funds and other funds created from the profit affect the implementation of Industry 4.0 elements. On the other hand, most of liabilities (long-term bank loans, short-term bank loans, short-term liabilities) show significant differences between businesses. It was found that the enterprises affected by Industry 4.0 reported a higher share of long-term bank loans, while enterprises not affected by Industry 4.0 reported a higher share of short-term bank loans.

In the future, this research will continue and deepen. We plan to analyze ratios such as profitability, liquidity, analysis of bankruptcy and creditworthiness models and more. The analysis of enterprises affected by Industry 4.0 has a high potential and will be used not only in the field of research, but also by the companies themselves, to help them decide about the introduction of Industry 4.0 elements.

Conclusion

The article primarily deals with the analysis of the relationship between financial indicators and Industry 4.0 and with a more detailed analysis of individual indicators. In assessing the financial indicators obtained from the balance sheet, a statistically significant differences were found between the enterprises affected and unaffected by Industry 4.0 in ten indicators out of seventeen analyzed indicators. Based on the Mann-Whitney U Test, it was found that enterprises affected by Industry 4.0 have higher values of total assets, intangible fixed assets, current assets, inventories, short-term receivables, equity, total liabilities, long-term bank loans and short-term liabilities. Only the short-term bank loans indicator have lower value for the enterprises affected by Industry 4.0. This is mainly due to the fact that companies that invest to the advanced technologies purchase the fixed assets (as was also statistically proven), which are appropriate to finance them with long-term resources. It was also surprising to find that enterprises affected by Industry 4.0 had a higher share of inventories (and thus current assets). These are probably the manufacturing companies. It is also the companies that have a higher proportion equity.

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Adjustments in Business Administration Studies induced by Industry 4.0

Abstract

The fourth industrial revolution, or Industry 4.0 for short, brings a variety of renewals and changes in the second and third decade of the 21st century for companies, politics and society. This also affects the education sector, which means that digitization does not circumvent the university system. Consequently, the business administration study also undergoes a change. After two research phases, I. Document Analysis and II. Expert Interviews, first renewals and demands on the business administration study were identified. Two further sequential online surveys with companies and universities¹ confirmed these points and derived important findings for business graduates with regard to the competence profiles. All interviewees who were interviewed in the three research phases agreed that digital literacy leads the way in redesigning the business administration studies. The derivation of possible master programme plans is currently pending. From the perspective of the author, the following aspects are expedient: better understanding of key figures, introduction of digitization modules.

Key Words

Digitization, the fourth industrial revolution, development of business studies in higher education, Business administration, important skills of graduates

JEL Classification: A23, M20, M21

Introduction

The proclaimed aim of the Bologna Process was to strengthen the employability of students in tertiary education. The goal of this research is to identify tools and competencies for practice-oriented education, based on continuing changes induced by Industry 4.0, to enable a quick entry into work life, just as Bologna demands.

In the literature, many keywords are used regarding Industry 4.0 or the fourth industrial revolution, such as the Internet of Things, cloud computing or cyber-physical technologies. For the sake of standardization, only the term Industry 4.0 is to be used in this paper. It is predicted that the current revolution, which will lead to epochal changes

¹ Within this paper, the term university is refereeing to the German term “Hochschule”, which is the German term for universities and colleges that are not authorized to confer doctorates.

in society, will continue for some time. The changing times have made it inevitable that Industry 4.0 is requested by the consumer in particular. For that matter, essential reasons can be stated: (LASI/KEMPER, 2015)

1. Development and innovation cycles: an important driver of success nowadays is the ability to innovate in combination with rapid achievability.
2. Individuality: the changing consumer behaviour leads to more and more individual products and services.
3. Flexibility: The two first-mentioned criteria are accompanied by flexibility. Consumers demand a short reaction time from the sellers.
4. Resource Efficiency: The scarcity of resources necessitates a rethink; for this reason environmental aspects and sustainability have changed the market.
5. Transformation/technology pressure:
 5. a) the automation of work processes,
 6. b) networking of technical components,
 7. c) increased computing power leads to miniaturization.

In this context, it is also referred to as disruptive and structurally changing technologies or transformations: Existing technologies are being replaced or completely displaced by the market since they are no longer necessary, and space is being made to tap into new technologies or markets. (HIRSCH-KREINSEN/WEYER 2014) Compared to the three previous industrial revolutions, the fourth revolution is not linear in terms of speed, but exponential and thus much faster. Schwab 2016 states three reasons for such acceleration. (SCHWAB 2016)

The Institute for Employment Research developed a scenario analysis on Industry 4.0 in 2016 to find out how the labour market will change by 2035. In the future, IT and natural science professions will play a pioneering role, as shown by the industry-based detailed analysis. In the manufacturing industry, by contrast, various jobs are no longer up-to-date by 2035, which does not mean, however, that these occupations disappear; rather they will have to change. Due to the digital influence, they are at most more complex and require interdisciplinary knowledge. For the present research, developments in the economic sciences were of interest, with a forecast of a slight increase of around 3 % until 2035. Altered tasks also play an important role here for the business administration sector with regard to Artificial Intelligence or Big Data. Based on this scenario analysis, other authors come to a similar finding. Universities are laying the foundation for this as they are promoters of education and such adaptations. Creativity and a high degree of abstraction are regarded as pioneering future drivers. (WEBER 2017)

1. Online Survey

After the two qualitative research phases I and II (document analysis and expert interviews), sequentially carried out online surveys followed. In which managers and HR managers from companies and university lecturers from the higher education sector were interviewed to analyze the changes in business administration studies induced by Industry 4.0.

From December 2018 to February 2019 a fully structured written survey took place. In the first online survey, 41 respondents from companies participated, followed by 30 people from universities who expressed interest in the second survey. In the two questionnaires mainly closed-ended questions were asked. The online questionnaire was adapted to each survey group, accordingly for companies and universities, and comprised a total of four question sections:

1. Introduction: topic and target group, short introduction of the person incl. contact possibilities, information on anonymity
2. Central questionnaire:
 - a) competencies: professional competence, methodical competence, social competence as well as personal competence as well as
 - b) measures: potential for improvement etc.
3. Statistics:
 - a) Company characteristics: inter alia Company name and domicile, sectors, number of employees, degree of internationalization,
 - b) University characteristics: inter alia name and place of university, study programme name and start of studies (start year), number of students etc.
4. Completion: next steps and evaluation of the results, possibility for feedback and approval

The pivotal point of this scientific survey was to find out what are the requirements for business administration studies and what measures can be derived. After the respective online survey has been evaluated, this paper is a consolidation of both results by a comparison of the company perspective and university view.

With regard to the terminology of Industry 4.0, the majority of companies and higher education institutions had favoured the answer 'information and technological change in economy, society and politics'. According to this, the frequency of responses was scattered in 'Internet of Things and the Internet of Services', 'Industry 4.0 like Digitization' and 'Industry 4.0 like Networked Production'. The least approval was attributed to the answer 2011 'Hannover Messe: Kagermann, Lukas Wahlster'. Very dynamic feedback was encountered on the question of whether there are opportunities or risks associated with Industry 4.0. The companies saw increased opportunities in Industry 4.0, but on the other hand, the university lecturers not as much. The surveyed universities tend with 2/3 to both risks and opportunities.

1.1 Training Programme Measures

In the qualification measures, the evaluation results of companies and universities are slightly different. The 'attendance/full-time study' was pushed differently by the companies and the university. The companies were more in favour with 24 mentions than the universities with 6 mentions. Differently it looks with 'part-time study', with similar trends among companies and universities, companies with 11 and universities with 12 mentions. The universities rather viewed the 'distance learning', which is usually independent of time and place, as a future trend in companies. This answer was given 15 times by lecturers and only 4 times by the companies. Based on these mentions, it can be

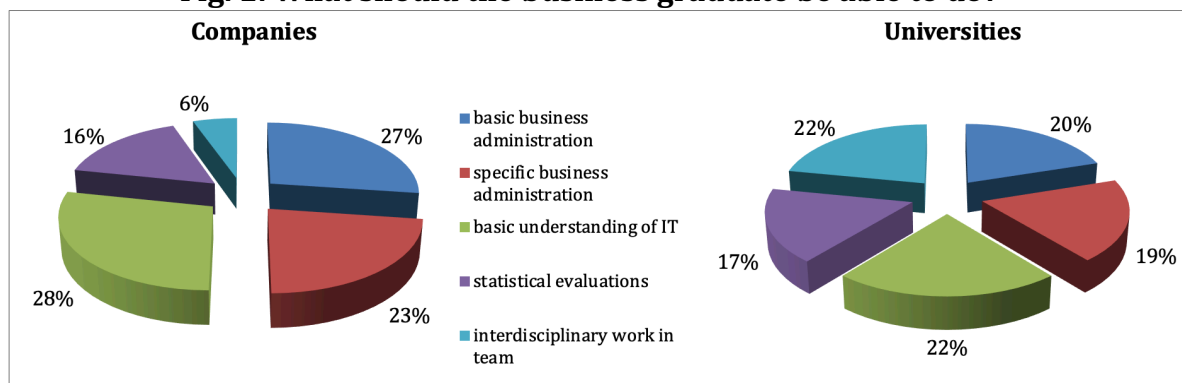
said that higher education institutions saw a more flexible and modular opportunity for further training than companies.

With respect to the digitization modules it could be said that the companies saw the focus on 'IT data protection', 'IT security' and 'IT law' since they had to comply with legal regulations and want to protect themselves against various cyber-attacks. This situation could not be inferred from the universities. Discarded and thus least interesting for companies were 'change management' and 'psychology', whereas 'change management' was rated as particularly important from the universities point of view.

The question regarding the integration of the digitization modules in the study was regarded very differently. The companies considered that the horizontal introduction would be better. The universities felt that a vertical and horizontal integration would be more effective. The author comes to the conclusion that a horizontal and vertical integration can succeed, so that the highest possible flow of information is given.

With regard to the future vision of the graduate in business administration, companies and universities agreed that a special role must be attributed to the 'basic understanding of IT', such as cloud, technologies, etc. Universities interpreted 'interdisciplinary work in team' also as significant, but it was insignificant for companies. The 'basic business administration knowledge' was second most important to both survey groups (see Fig. 1).

Fig. 1: What should the business graduate be able to do?



Source: authors' own figure

1.2 Competence Profiles in Business Administration Studies

Thus, the requirement profile regarding the competencies of business graduates was examined from the point of view of companies and universities. It showed that universities gave mostly better marks in the weighting of competences, although the values are very close to each other. With the detailed consideration it could be stated that the companies rather rank the professional competence as the most important characteristic of a business administration bachelor and the universities instead the social competence. In the distribution of competencies of the master's graduates, it turned out that the professional competence is more meaningful than in the case of the bachelor graduate. Both rating groups rated it at 1.4. For companies, data on the importance of competences of master's graduates spreads more than in universities and in the assessment of bachelor's graduates (see Fig. 2). Although the individual characteristics

vary according to competence, a detailed analysis is omitted here in order to preserve the scope of this paper.

Fig. 2: Weighting of competencies for business graduates

Competencies	Companies	Universities	Companies	Universities
	Bachelor		Master	
Professional compet	1.6	1.7	1.4	1.4
Methodological compet.	1.8	1.7	1.9	1.4
Social compet.	1.9	1.6	2.0	1.4
Digital literacy	1.7	1.7	1.6	1.7

Source: authors' own figure

Considering the majority of companies, companies considered the 'role model of the professorship' regarding the changed framework conditions at universities. They called for the professors to see themselves rather as a mentor. From a university perspective, this answer was chosen least, which is understandable, since the Humboldtian educational ideal – freedom of teaching and research – exists in Germany. Legitimately, the question must be asked whether professors in the increasingly fast-paced world can have an answer to everything in the future. The universities and companies also came to the conclusion that a 'stronger interdisciplinary nature' must be established. This means, for example, that courses of study are offered across modules or that projects are being worked on, since a company also works with different job profiles on one project. The interviewees also wanted to focus on modular further education opportunities at universities in order to get knowledge conveyed in small learning units: keyword learning nuggets. This means small, mostly up to five minutes long learning units, in order to quickly convey the employee, according to his task, precise knowledge over a longer period of time. The short or small units and repetitions allow a long-lasting and targeted learning success. (BÄR et. al. 2018)

A heterogeneous picture showed the question of a joint exchange with educational institutions on the subject of digitization. Overall, 68 % of the 41 companies surveyed were in favour of an exchange. On the other hand, only 1 % of 30 respondents of the university lecturers requested such an exchange. In other words, companies would like to influence university teaching in order to integrate practical content into teaching, which universities vehemently denied.

Further targeted questions on the respective sector, degree of digitization of companies, type of university, previous changes in business administration studies with regard to digitization, etc. were provided and their results are also available, to a high degree of detail.

2. Results of the Research

The present study corresponds to the mixed methods research design. After the first two qualitative research phases have been evaluated with the help of MAXQDA, the focus is on the third quantitative research phase. The two online questionnaires were examined by means of IBM SPSS Statistics Version 25, each with 26 questions. For the answers, each

variable consisting of several items was checked for plausibility in the first step and an adjustment was carried out with the help of Cronbach's alpha. In this way, optimization possibilities were searched for in order to quantify the consistency of the individual variables and the reliability. The next step was to contrast the individual results of the companies and educational institutions identified by SPSS. In this way it was possible to map out commonalities and differences and to derive essential insights for this work.

Out of a total of 13 hypotheses, five consolidated hypotheses could be considered in isolation, since a direct comparison was possible. In the following, only these five hypotheses will be considered more closely in order to preserve the scope of this paper. The author has performed a categorical distinction of the level of the 'p value' or the 'probability of error' in Fig. 3.

▪ **Fig. 3: Consolidation of the hypotheses**

Comparison of the hypotheses		p value companies	p value universities
H4 vs. H4	The basic knowledge of a graduate in business administration is more important for work life than technical specialization.	0.217	0.527
H5a vs. H5d	The methodological competence of business graduates is more important to respondents than their professional competence.	0.000	0.051
H5b vs. H5e	The methodological competence of business graduates is more important to respondents than social competence.	0.000	0.001
H5c vs. H5f	The methodological competence of business graduates is more important to the respondents than digital literacy.	0.000	0.002
H8 vs. H9	For companies, modular training (module studies, certificates, part-time study) is more important to employees than attendance study.	$\bar{x}$: 22x further training vs. 19x attendance study program	$\bar{x}$: 21x further training vs. 6x attendance study program

Source: authors' own figure

If the individual 'p values' are compared, an interesting picture appears. Hypothesis 4 was used to create a difference hypothesis. The required null hypothesis is as follows: The 'basic knowledge' and the professional specialisation' are equally significant for work life. To do this, the two variables chosen were professional specialization' and 'basic knowledge'. Both variables are interval scaled and are shown by scale points. To make a statement, the rank correlation analysis according to Spearman was chosen. The correlation shown has a p value = .217 from the company's point of view and a p value = .527 at the universities. H4 was falsified among companies and higher education institutions, but still there was a visible link. This relationship seems to be more pronounced among companies than at universities. As a result, it can be confirmed that 'basic knowledge' of master's graduates appears to be more important to companies than to higher education institutions.

The hypotheses 5a/5d are strictly speaking a difference hypothesis and the necessary null hypothesis is that 'methodical competence' is just as important as the 'professional competence'. The variables are 'methodological competence' and 'professional

competence', both are interval scaled and reported in scale points. Again, the rank correlation analysis of Spearman was applied. The correlation between these two characteristics shows a p value = .000 for companies and a p value = .051 for universities. As a result, companies argue that 'methodological competence' of business graduates is more important than 'professional competence', which could be considered highly significant given a likelihood of error of less than 1 %. Higher education institutions indicate a strong correlation, but this is not significant. The same methodical approach was used for hypotheses 5b/5e. The relationship between 'methodological competence' and 'social competence' of business graduates was examined. Companies as well as higher education institutions showed a likelihood of error of less than 1 %. The same applies to hypotheses 5c/5f, which shed light on the connection between 'methodological competence' and 'digital literacy' among business graduates. Both survey groups confirmed with a probability of error of less than 1 % that 'methodological competence' was more important than 'digital literacy'.

In the section 1.2 considered above, the competences were also juxtaposed, with 'professional competence' as the main competence. By contrast, the static verification of hypotheses 5, in which methodological competence was rated as much more important, is contradictory. The author therefore advocates the future relevance of methodological knowledge and understanding; more on this issue in the conclusion.

Hypotheses 8/9 should discern a difference between modular training, in essence, module studies, certificates, part-time study, and attendance study programme. The accompanying null hypothesis is: Companies see no difference between modular training and attendance study programme. The variables module studies, certificates, part-time study were combined into one variable called 'further education', so that the two nominally scaled variables 'modular further education' and 'attendance study programme' were then compared with each other. As a result, it can be deduced that the companies and universities tended towards 'modular further education' rather than 'attendance study programme'.

Conclusion

The author found out with the help of the three research phases, which are based on a mixed method design, that the business administration study is subject to change and that from the company and university view an adjustment must be made. The Business Administration Study nowadays also requires digital skills in addition to the usual skills. These are skills that support the procedural and technological knowledge that accompanies Industry 4.0. In Addition to that, it is important to know the opportunities and risks of a technology but also its limitations.

Key figures already have a high relevance these days and are an existing field of activity for business graduates and will continue to gain importance in the future. This requires statistical knowledge with the aim of understanding and verifying key figures as well as taking the necessary steps. The business graduate must also have a basic understanding of IT in order to acquire knowledge about technologies currently used in the company.

The methodological competence seems extremely important to the survey groups, because what seemed important in the past is no longer sufficient today. A great value is

placed today on the methodological competence instead of the professional competence. The author is certain that the constantly changing demands in the professional world induced by Industry 4.0 require more methodological competence, as the professional requirements will definitely change and because the glance into the crystal ball does not meet the scientific requirements.

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In memory of professor S.D. Nikolaev

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Influence of implementation of the Lean Production concept on development of market structures

Abstract

The paper analyzes impact of implementation of the Lean Production concept on development of market structures as a significant factor of innovative development of market structures and increasing competitiveness. It is pointed out that a developed competitive environment is an important factor for efficiency of innovative activities of high-technology enterprises that is required to improve the standing of high-technology business on a competitive market. From the macroeconomic point of view, when fringe firms implement Lean Production, it can result in the price decrease and GDP growth. It is substantiated that the state support of small and medium enterprises in such ways as the tax burden decrease, subsidies for modernization and implementation of modern production management technology smoothens costs of firms of the competitive fringe and a dominant firm that does not have access to such benefits. It all creates unique conditions for transforming and improving the market structure.

The following scientific research methods have been used to prepare the paper: graphical and analytical methods, deductive analysis and statistical methods.

Key Words

fourth industrial revolution, lean production, high-technology enterprise, dominant firm, competitive fringe, competitive environment, oligopoly, market structure

JEL Classification: D43, H71, O12, O14, O31, H71.

Introduction

The advancing Fourth Industrial Revolution is linked currently to the use of information technology in industrial processes. Its revolutionary character is in application of the IT concept in industrial production and integration of computing power into physical processes. Such complex structure aggregates high-technology equipment and

information systems in a unified management system along the entire product value-added chain. The chain encompasses a producer, its suppliers, and customers; the chain goes beyond a single enterprise. At the same time, not only newly-created business relationships between producers, suppliers, and customers undergo drastic changes, but also the existing links between the human and the machine. Therefore, the “Fourth Industrial Revolution” signifies the emergence of the completely digitalized industry, substantiating the transition of enterprises to total digitalization. Such process requires mutual integration of information technology and industrial production.

Market structures are a relatively stable occurrence in the modern economy. Their theoretical development from perfect competition, not existing in reality, to imperfect competition was influenced by economic, technical, and technological progress. In the economic history all stages of the industrial revolution have logically changed market structures from elements of perfect competition to monopolistic competition and then from various types of oligopoly to monopoly.

1. Methods of Research

The first version of market structures that influence significantly functioning of economies were defined in the XIX century. They are in essence the current reality, though their specific forms are constantly evolving. It is assumed that there would be a certain transition from monopolies to oligopolies in the context of the Fourth Industrial Revolution with possible exceptions. Companies would be able and would have to produce more goods than ever within the increasing yield of production. Yet, they would compete more on the ever-changing open global market. Probably, there would be less and less enterprises in traditional industries because some of them would lose the competitive fight in conditions of Industry 4.0 and cease their operations. However, paradoxically, there would be more companies constantly competing under such conditions on an open global market. Subsequently, they would create a new object of the market structure, an original fusion of a cartel and an oligopoly with a dominant firm.

The following scientific research methods have been used for preparation of the paper: graphical and analytical methods, deductive analysis and statistical methods.

2. Results of the Research

Peculiarities of implementing the Lean Production concept at enterprises during realization of high-technology business

A high-technology enterprise is one of the major structure-forming elements of the national innovations systems on the verge of the Fourth Industrial Revolution. Such class of economic subjects orients towards creating, mastering, and applying in practice a set of innovations, including technological, marketing, financial, organizational, managerial, and other types of innovations. Therefore, when an enterprise engages into innovative activities, it leads not only to modernization of its functional subsystems but also to the necessity to develop organizational and economic mechanisms of the transition and

adaptation of the enterprise's operations in the changing economic space. Therefore, the authors will continue to demonstrate how implementing advanced managerial techniques (particularly – the Lean Production concept) makes a significant impact on forming various market structures.

The forms of market structures are constantly evolving. An important development factor is the onset of the Fourth Industrial Revolution. The reality and essence of the Fourth Industrial Revolution, as well as the economic and technological development of the society contributes to changes in the competitive environment. Thus, implementing advanced methods for organizing and managing business processes becomes a topical issue for enterprises of high-technology industries. With the advance of the Fourth Industrial Revolution high-technology enterprises must not only apply but also develop various managerial techniques. Developing techniques for managing business would enable the enterprise to solve the task of increasing its integral potential and efficiency of activities, as well as secure the market value growth (Kraft, Zaytsev, Zaytsev, 2017).

Modern production management technologies enable high-technology enterprises to solve the task of increasing its potential not only via rational use of resources but also via identifying sources of hidden wasting of such resources. Such class of wasting is often referred to as “hidden” in economic activities of an enterprise. As a rule, this is the main negative factor and the reason why efficiency of the enterprise functioning decreases and the growth dynamics of its market value slows down. However, implementing the Lean Production concept increases potential of the high-technology enterprise via revealing sources and origin points of hidden wasting, identifying and eliminating them.

Implementing the Lean Production concept at the enterprise leads to:

8. • reducing material and other costs comprising the structure of cost of goods sold (COGS);
9. • minimizing the working capital to the level at which the enterprise maintains the required financial stability.

By orienting towards implementation of the Lean Production concept the management is able to optimize and synchronize production processes to reduce management costs in all elements of the structure, internal production costs of transporting tangible resources, and administrative costs (Kraft, Zaytsev, Zaytsev, 2017).

Such approach to cutting production costs and reducing expenses maximizes the market value of a high-technology enterprise, forms competitive advantages from joint work of all units of the company. The advantages would enable to create economic value added in future. However, it is necessary to point out the following phenomenon in the field of establishing market structures brought forth by realization of managerial techniques: implementation of the Lean Production concept at enterprises affects significantly transformation of market structures and, consequently, development of processes of the Fourth Industrial Revolution.

Development of market structures due to implementation of the Lean Production concept at high-technology enterprises

An oligopoly with a dominant firm is a quite common market structure of imperfect competition. It is a more beneficial type of the market structures for economies in general and from the point of demand for produced goods. Among its advantages is the fact that it provides a lower product price and higher production output than monopolistic competition (competitors-monopolists). Exactly for these reasons an oligopoly with a dominant firm is at the same time the worst possible market structure compared to monopolistic competition.

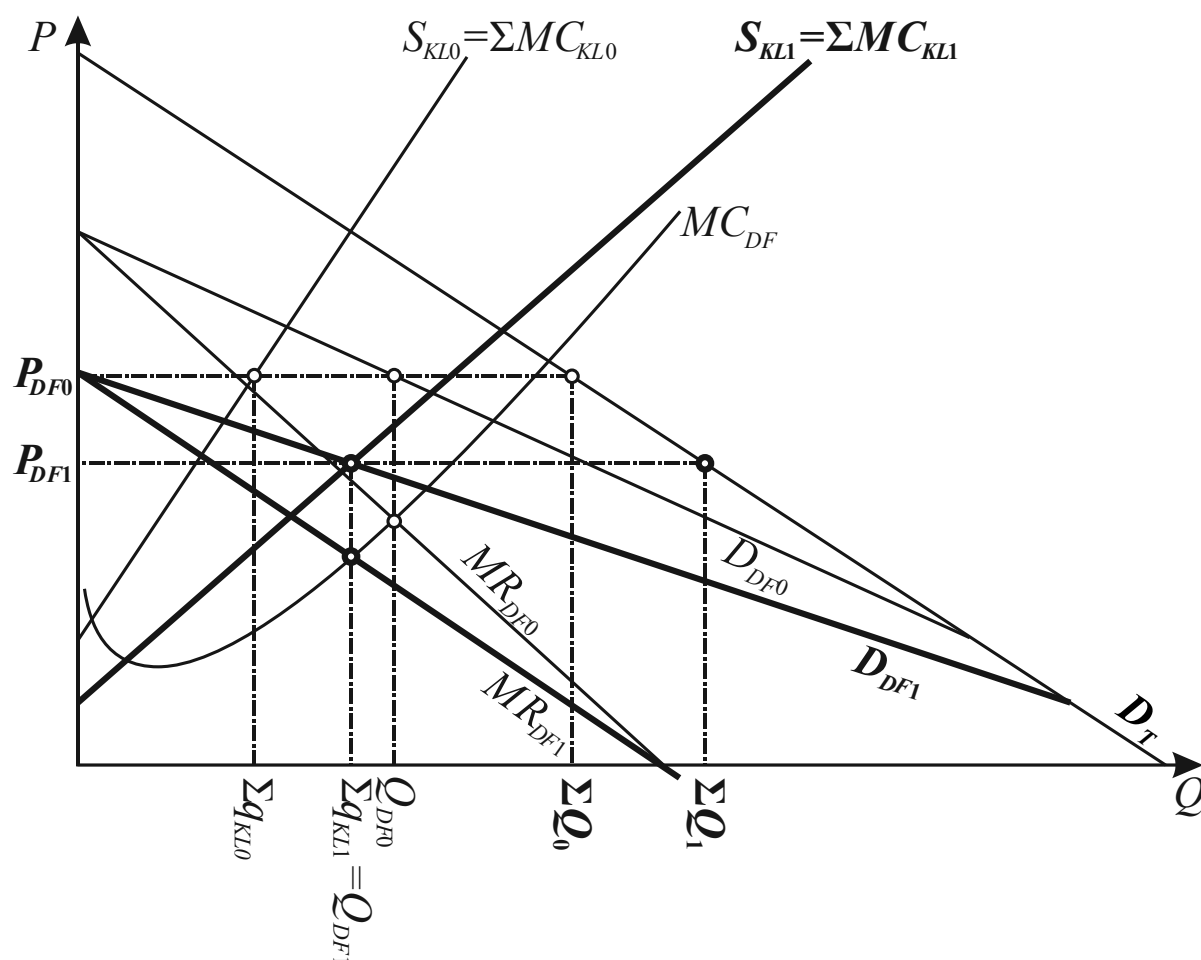
In case of an oligopoly with a dominant firm companies belonging to the competitive fringe are subjects with limited opportunities in terms of supply. Price-wise they are dependent subjects in circumstances when the price is set by a dominant firm. The dominant firm also indirectly determines limits of the production output that fringe firms can produce.

However, fringe firms can surpass this unfavorable position. One of the possible solutions of the modern management is to implement advanced managerial techniques, e.g. Lean Production. As a result of applying such approaches, the supply curve for fringe firms would shift to right because realization of Lean Production leads to reduction of COGS for the firms. Supply of the subjects on the competitive fringe moves from SKL0 to SKL1. Subsequently, the demand for goods of the dominant company would shift from DDF0 на DDF1. In turn, it would lead to decrease of the production output of the dominant firm from QDF0 to QDF1 (vide Fig. 1).

At the same time, the production output of the competitive fringe increases from ΣQ_{KL0} to ΣQ_{KL1} , as well as the total output ΣQ_0 from ΣQ_1 . Meanwhile, the share of the dominant firm in the output decreases, resulting in the equilibrium between the output of the dominant firm and the output of the fringe firms, i.e. $\Sigma Q_{KL1} = Q_{DF1}$ (vide Fig. 1).

From the macroeconomic point of view, implementation of Lean Production by fringe firms can lead to decreasing prices and increasing GDP. Therefore, the state can assess such innovative programs and provide benefits (preferential treatment) to small and medium enterprises on the competitive fringe. This preferential treatment should cover only fringe firms not the dominant one with such measures as reducing tax burden, providing subsidies for modernization and reengineering, including implementing modern production management techniques. If small and medium enterprises receive such state support, costs of fringe firms with benefits and the dominant firm without benefits become equal. Thus, unique conditions for transforming monopolistic competition are created.

Fig. 1: Changes in the structure of an oligopoly with a dominant firm after a fringe firm implements Lean Production



Source: authors' plotting.

Legend:

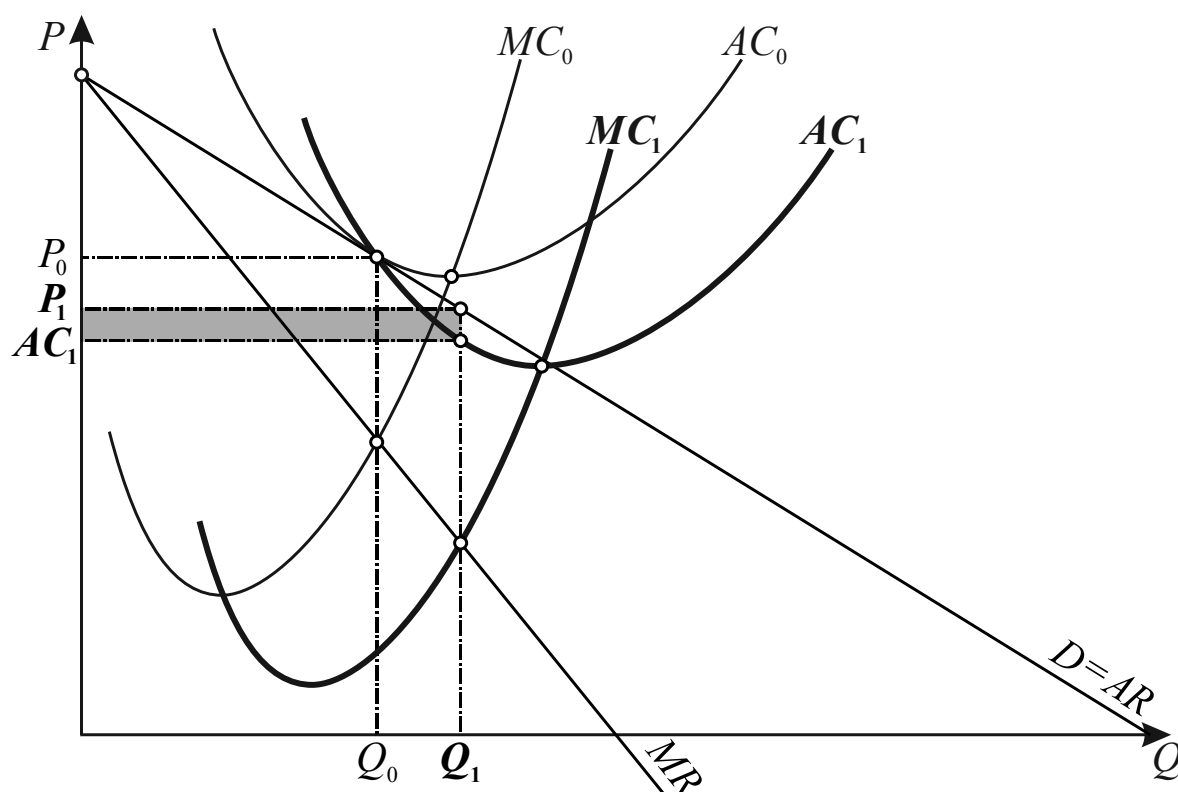
P	Price	$\Sigma MC_{KL0} (1)$	Total increasing part of Marginal costs of fringe firms
Q	Product quantity (production output)	MC_{DF}	Marginal costs of a dominant firm
$S_{KL0} (1)$	Supply of competitive fringe	$P_{DF0} (1)$	Price set by a dominant firm
$MR_{DF0} (1)$	Marginal revenue of a dominant firm	D_T	Total demand for goods of an oligopoly with a dominant firm
$\Sigma q_{KL0} (1)$	Total production output of the competitive fringe	$D_{DF0} (1)$	Demand for goods of a dominant firm
$Q_{DF0} (1)$	Total production output of the dominant firm	$\Sigma Q_0 (1)$	Total production output

3. Discussion

The main advantage of monopolistic competition as compared to an oligopoly with a dominant firm is in increasing the total production output from Q_0 to Q_1 , consequently, stimulating the GDP growth. However, the process of economic pressure generates not

only increase in total production output but also affects significantly the price reduction from P_0 to P_1 , which can cause a price fall and a general anti-inflation effect; though it is not the most important aspect.

Fig. 2. Pressure to adjust applied technology within monopolistic competition with zero economic profit in a long run



Source: authors' plotting.

Legend:

AC₀₍₁₎	Average costs before and after implementing technology	P₀	Price for product in a long run
AR	Average revenue	P₁	Price for product in a short run after implementing technology
MC₀₍₁₎	Marginal costs before and after implementing technology	For other denominations refer to Fig. 1	
Highlighted grey zone is economic profit from realizing technological modernization and/or implementing modern production management technologies			

It is important that zero economic profit is generated in a long run for all economic subjects of monopolistic competition. In turn that stimulates them to upgrade production and management technology for their own sake and, as a result, to reduce costs AC_0 and MC_0 to AC_1 and MC_1 respectively. Therefore, only those subjects that determined their actual status in the newly-formed competitive environment would obtain a positive value of economic profit. The effect is demonstrated in Fig. 2 (grey zone) by the cost curve shifting right low.

Conclusion

The analysis of influence of the Lean Production concept on development of market structures has demonstrated that researchers and analysts seldom look into or discuss innovative market structures while researching innovative processes and proposing innovation management methods. In modern conditions economic subjects gradually start directing more attention to researching the problem of innovative development of market structures because competitiveness can emerge only in a competitive environment. Therefore, the competitive environment is an important factor of efficiency of innovative activities of high-technology enterprises – both on a national and world scale.

Accelerated development of technical and economic levels of enterprises leads to monopolization on one hand; however, on the other hand, expanding the influence territory of economic subjects leads to demonopolization – first of all, due to strengthening globalization processes. In such case it is about demonopolization that forms real conditions for doing business in the market structure but that does not lead to perfect competition. Such development of the competitive environment results in an oligopoly that can take form of a cooperative oligopoly or an oligopoly with a dominant firm. By influencing a market structure it can be transformed into a form of imperfect competition resembling a perfect competitive environment.

In conditions of a real market an oligopoly is such form. An oligopoly with a dominant firm contributes most to development of competition. At the moment such environment is strengthened by the state support for small and medium firms that in reality operate in a close cooperation with a dominant firm which is often is a former monopoly. In the existing world economic system real conditions are created for effective use of such market structures.

Small and medium enterprises belonging to the competitive fringe in such market structure actively interact with a dominant firm. While forming price policies, enterprise must take into account that product prices of a dominant firm on an oligopolistic market are, as a rule, lower than prices of small and medium enterprises. However, fringe firms can change such situation by transforming the market into the environment of imperfect competition on the basis of innovative activities (implementing modern management technology) and state support.

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Robotic process automation in the Czech financial sector

Abstract

The robotic process automation (RPA) is relatively scarcely covered as a topic in academic resources despite the fact that it is the part of the current technological revolution driven by intelligent technologies. The RPA applications are usually adopted along with machine learning innovations. The RPA brings automation to processes previously done by humans and changes also conditions on the labor market. Generally, the financial sector has great potential for the application of the RPA. Processes in this sector are in high-volumes, standardized or strongly rule-based and having sufficient maturity. Financial companies have to deal with the pressure on integration and not only internal but external (3rd parties access) as well. Results suggest that is very important the cooperation between the IT department and other business units. A new mindset of employees should be achieved before the RPA introduction. The RPA is suitable for the financial sector in the Czech Republic. The level of business process integration is mostly high or highest in the area of inventory, finances, customer relationship management, logistics and operations in the banking sector, insurance, other financial services, and the lowest level of business process integration is in the field of auxiliary financial services. Qualitative aspects of RPA in the Czech financial sector seem to be the same as described in previous researches on this topic but there might be the quantitative difference and further research should be done.

Key Words

robotic process automation, process management, innovations, the financial sector

JEL Classification: O33, M15

Introduction

The worldwide jump in intelligent technologies brings innovations in many fields and the robotic process automation (RPA) is one of them. Together with artificial intelligence applications, it may create similar movement in society as seen in previous industrial revolutions. This technical revolution might be different because it is not about physical powers - it targets human mental powers. That is why the result of this technical revolution might be different as seen in previous technological revolutions. This time machines can completely replace human workers (Carr, 2015). And if not completely replace them then at least free them from routine jobs (Ford, 2017). State regulations can

handle the impact of the new technologies but these regulations are slow and have rather an ambivalent impact (Mendling et al., 2018).

The robotic process automation is relatively scarcely covered as a topic in the Web of Science (WoS) or Scopus database. There are 28 papers or proceedings currently in both databases. The most cited paper is about annual returns on investment (ROI) of the RPA of routine back-office processes at Telefonica O2 (Lacity and Willcocks, 2016). The paper gives a great background to do an RPA research.

The ROI was around 200 % and five “RPA Action Principles” were suggested also by companies operating in different industries. Firstly, a controlled experiment is suggested to test RPA capabilities. There are certain criteria for determining which processes can be automated. For example, processes which are: high-volume, standardized or strongly rule-based, and mature processes. Next suggestion is to bring IT on board early, because of IT security and change management policies. People will start fearing that RPA technology is going to take their job, it is necessary to communicate the intended effect on jobs early in the RPA project. Last suggestion is to look for more sourcing options, like insourcing (buy licenses) with or without consulting services; and outsourcing via RPA, cloud RPA or other Business process outsourcing (BPO) providers (Lacity and Willcocks, 2016).

Three lessons for internal RPA adoption are suggested by Hallikainen, Bekkhus, and Pan (2018). Again, the role of the IT department is crucial. It needs to be involved in the development, testing and production phases of the RPA project. Concerns of key employees about losing jobs have to be addressed by managers and employees have to feel comfortable when adapting to the change. Last suggestion is to select processes which are rules-based and require significant amounts of time and resources and the improvements have to be measured and evaluated. External RPA adoption is more suitable for organizations with hybrid structure. The high level of long term trust between BPO and the enterprise is key for providing value added to clients.

This paper aims at financial institutions but the RPA can be used in all enterprises in application areas like financial management and accounting, IT infrastructure maintenance, and front-office processing. The RPA applications are usually adopted along with machine learning (ML) innovations.

The market of financial services is changing due to so-called “FinTech” revolution (banks granting access for the 3rd parties to their system). So there is a great potential for application programming interfaces (APIs), robotic process automation (RPA), artificial intelligence (AI), internet of things (IoT), and distributed ledger technology (DLT). In the case of RPA, banks are mostly aiming to lower costs in routine manual work and to deliver tangible added value to the client (Mager, 2019).

1. Methods of Research

The research was divided into 2 parts. (1) The quantitative part analyzed the RPA situation in the Czech financial sector. Methods were based on the econometrics of Czech

Statistical Office data. (2) The qualitative part analyzed important aspects of RPA as seen from a practical point of view. Methods were based on interview and data are presented as a case study from the Czech financial sector.

1.1 Quantitative part - Hypotheses, data, and methods

We used standard statistical hypotheses testing using χ^2 tests (goodness-of-fit). The hypotheses are aimed at differences between 4 branches of financial enterprises (Tab 1) and variables that relate to RPA, business process integration (BPI), and other ICT activities ICT (Tab 2). Additionally, we tested also hypotheses about differences between the size of the enterprise (Tab 3) and other variables of interests (Tab 2).

Tab 1: Frequency of types of economic activities

Abbr.	Type	NACE	Freq.	Percent	Cum.
AUX	Auxiliary activities	661-663	120	46.88	46.88
MON	Monetary intermediation	641	42	16.41	63.28
OTH	Other financial service activities, except insurance and pension funding	649	56	21.88	85.16
INS	Insurance and reinsurance	651-652	38	14.84	100

Source: Czech Statistical Office, authors' calculations

Data about ICT activities in 2014 comes from the Czech Statistical Office official survey. The questionnaire contains all kind of questions regarding the use of ICT (Czech Statistical Office 2015). Only some of the economic activities from the financial sector are analyzed (Tab 1). Almost half (46.9 %) of the sample is represented by financial enterprises that are characterized by activities auxiliary to financial services and insurance activities (AUX). Banks, savings banks and credit unions are represented by 16.4 % and labeled as monetary intermediation (MON). There are 21.9 % leasing, factoring and consumer credit enterprises that are labeled as other financial services (OTH). The last group is represented by 14.8 % and consists of life and non-life insurance and reinsurance enterprises (INS).

The summary statistics of variables used in the results section are provided in Tab 2. The variation coefficients of all variables are quite high. There are differences between companies based on their size (Tab 3) and industry type (Tab 1). On average, almost half of all enterprises have CRM and ERP systems. CRM data about clients are available to other information systems in 45 % of the enterprises in the sample. About 21 % of enterprises develop their SW in-house. The most integrated business processes are in finances (54 %) and operations (31 %).

Tab 2: Summary statistics of enterprises' characteristics and variables of interest

Characteristics of enterprises	N	Mean	SD	Max
IT workers (internal and external)	256	13.7	52.02	549
Programmers (internal and external)	256	4.13	16.75	205
Number of in-house SW developers (programmers)	256	3.91	16.66	205
In-house SW developers/programmers (% of time - development)	256	26.92	37.86	100
Number of in-house SW developers (non-programmers)	256	4.81	30.76	344
In-house SW developers/non-programmers (% of time - development)	256	12.66	26.7	100
Variables of interest	N	Mean	SD	Max
SW in-house development	256	0.21	0.41	1
SW external development (outsourcing/cooperation)	256	0.65	0.48	1
ERP system implemented	256	0.46	0.5	1
CRM system implemented	256	0.49	0.5	1
CRM data available to other IS	256	0.45	0.5	1
Business process integration - inventory	256	0.2	0.4	1
Business process integration - finances	256	0.54	0.5	1
Business process integration - operations, services	256	0.31	0.46	1
Business process integration - logistics	256	0.24	0.43	1

Source: Czech Statistical Office, authors' calculations

The last variable is used for additional testing between the sizes of enterprises. In the data sample, there are only 2 micro-enterprises with 1 or less employee. The company sizes are well represented given the fact the analysis is in the 4 branches of the financial sector (Tab. 1) where there are medium-sized to large companies.

Tab 3: Frequency of the number of employees

Number of Employees	Freq.	Percent	Cum.
0 to 9	52	20.31	20.31
10 to 29	74	28.91	49.22
30 to 99	69	26.95	76.17
100 plus	61	23.83	100

Source: Czech Statistical Office, authors' calculations

1.2 Qualitative part – Research questions, data, and methods

The research was performed in the bank ČSOB, a.s. where more than 30 processes were automated. To prevent the selection bias, respondents were chosen randomly from different departments of the bank. The research was performed on owners of fully automated processes or owners of processes in the final part of automation (babysitting). The research question was aimed at their experience with RPA implementation.

This research covers 13 processes from different units of the bank (Retail back-office, Corporate back-office, HR, Compliance, and Credits). The size measured in full-time employees (FTE) and maturity level is described in Tab 4. The maturity of the process is measured by the Capability Maturity Model (McKay, 2019).

Tab 4-Number of processes in the study

Maturity/Size	<0,5 FTE	0,5-2,0 FTE	<2 FTE	Total
Level 1 - Initial	0	0	0	0
Level 2 - Repeatable	1	0	1	2
Level 3 - Defined	1	2	1	4
Level 4 - Managed	1	3	1	5
Level 5 - Optimizing	0	1	1	2
Total	3	6	4	13

Source: authors' evaluation

The interviews were done separately using a semi-structured questionnaire with open questions. Questions aimed to cover all phases of the RPA process (1. process selection/preparation, 2. automation implementation, 3. business-as-usual working). The results presented in this paper are based on six interviews with owners of the processes and one control interview with a consultant providing services in the area of business architecture in CSOB a.s. and other banks. This control interview can eliminate potential bias.

2. Results of the Research

Quantitative part results

Auxiliary activities were mostly the cause of differences in case of business process integration of inventory activities and in case of the ERP system. In other cases, the variability was substantial and all the branches varied. The ratio of in-house and external SW development is the same in all four branches (Tab 5).

Tab 5: Relationship between economic activity (4 branches) and variables of interest

Business process integration - inventory	Group variable	Pearson X²	p-value	
Business process integration - inventory	4 Branches	10.5	0.015	**
Business process integration - finances	4 Branches	9.2	0.026	**
Business process integration - operations, services	4 Branches	2.3	0.512	
Business process integration - logistics	4 Branches	4.3	0.230	
ERP system implemented	4 Branches	16.0	0.001	***
CRM system implemented	4 Branches	12.9	0.005	***
CRM data available to other IS	4 Branches	14.3	0.003	***
SW in-house development	4 Branches	1.3	0.725	
SW external development (outsourcing/cooperation)	4 Branches	0.5	0.917	

Source: Czech Statistical Office, authors' calculations

The size was a factor of variability in case of business process integration (inventory and finances), ERP system integration and the ratio of in-house SW development. The direct relationship was observed in the case of inventory BPI (from 5 to 20 %) and in-house SW development (from 11 to 31 %). In other cases, the null hypotheses were accepted (Tab 6).

Tab 6: Relationship between the number of employees (size category) and variables of interest

Business process integration - inventory	Group variable	Pearson X ²	p-value	
Business process integration - inventory	Size	19.6	0.000	***
Business process integration - finances	Size	9.4	0.024	**
Business process integration - operations, services	Size	3.9	0.274	
Business process integration - logistics	Size	1.0	0.795	
ERP system implemented	Size	15.2	0.002	***
CRM system implemented	Size	2.4	0.498	
CRM data available to other IS	Size	1.8	0.606	
SW in-house development	Size	6.9	0.076	*
SW external development (outsourcing/cooperation)	Size	0.4	0.941	

Source: Czech Statistical Office, authors' calculations

Qualitative part results

The first key finding was that RPA as a method is not a source of main complications in RPA implementation. This conclusion is based on the fact that in none of the interviews was mentioned any trouble connected directly to the RPA itself. There was no mentioning of technical issues nor problems with the development of robotic algorithms, and bugs causing delay, etc.

A very important finding is that RPA is a lot about changing of workers mindset. Nearly all respondents mentioned that their workers had feared losing control over their process. This slowed down the whole implementation. Also, employees responsible for granting access to company systems often denied access rights to robots. The same problem was with setting up new methodology or standard including software robots in the process. Their results regarding responsible employees of RPA implementation suggest a combination of process skills, communications skills, and programming skills which are not easy to find on the labor market.

The next finding is connected to the process of maturity. If the maturity of the process is low then the RPA seems to bring more complications than savings. Process analysis and its optimization are necessary for RPA implementation and cannot be omitted. If so, there is probably a high risk of bugs during implementation. The RPA is more complex and should not be seen only as a solution for every routine job. Unless the process analysis was already done. The maturity of the process also influences the meeting of expectations in a number of FTE savings. Immature processes saved less FTE because more tasks had to stay in the hands of human workers.

From a more technical point of view, there is an issue of input data quality. Software robot needs precise working interfaces which are not easy to achieve. The robot works better in the beginning and at the end of a process. The cooperation of the human worker and robot in the middle of a process may cause delays or mistakes. On the other hand outputs of robots seems to be without mistakes. This could lead to better data quality within the company in the future. Not only data quality plays a crucial role but also the quality of systems in which the robot operates. The efficiency of the robot is dependent on system

reaction times. If it is implemented on slow systems (or on systems with long system recovery time) it will not meet the full potential.

3. Discussion

Issues connected to the RPA discovered in previous researches were very similar to our findings. In our case study, we showed that proper process selection is based on maturity (Lacity and Willcocks, 2016), on rule-based criterion (Hallikainen, Bekkhus, and Pan, 2018), employees mindset awareness, integration of business processes, sharing data and information and IT involvement in the RPA targeted process (Lacity and Willcocks, 2016; Hallikainen, Bekkhus, and Pan, 2018).

The value added of this research is in the analysis of the interfaces between automated processes and processes done in the traditional way (including human workers). It is the first analysis of RPA in the Czech financial sector and it is based on the rather old data set (2014) and interview in one of the larger banks in the Czech financial sector. Further research should focus on critical factors of RPA implementation and the „organizational culture and human labor impacts“.

Conclusion

There is a potential for the RPA in the banking sector (NACE 641). It is given by the highest average number of programmers. The IT department and ICT workers are essential in smooth RPA development (Lacity and Willcocks 2016; Hallikainen, Bekkhus, and Pan, 2018). The level of the business process integration is mostly high or highest in the area of inventory, finances, CRM, logistics and operations in the banking sector, insurance, other financial services, and the lowest level of BPI is in the field of auxiliary financial services.

The quantitative part dealt with indirect indicators and showed differences between four industry branches and four size categories of enterprises in 2014 in the Czech Republic. The goal of this part was to map the industry and look for differences in ICT processes and other characteristics. In some cases, the size category and industry branch did not matter. The share of in-house and extremal SW development is similar in all branches, i.e. there are no statistically significant differences.

The qualitative part showed very similar results as previous researches. The RPA should not be seen only as simple automation but as a very complex instrument offering a lot of advantages if it operates in a precise working and stable company environment. Further research should be focused on the changes caused by RPA on management structures in companies and the behavior of their employees.

There is also the question of losing knowledge and skills by which human workers may suffer. From a technical point of view, the RPA is only a bridge to more sophisticated IT innovations. It is expected that AI together with RPA will influence the labor market by increasing productivity in other services as well.

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